THE INTEGRATION OF ICT

TO ENHANCE 21ST CENTURY SKILLS IN SCHOOLS

by

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Declaration

I, **Fotiene Avrakotos**, student number 218105228, hereby declare that:

- The work in this dissertation is my own work.
- All sources used or referred to have been documented and recognised.
- This dissertation has not previously been submitted in full or partial fulfilment of the requirements for an equivalent or higher qualification at any other recognised institution.
- I am mindful of the University of Johannesburg's policy on ethics in research and I have taken every preventive measure to comply with the set regulations. I have obtained ethical clearance from the University of Johannesburg's Research Ethics Committee.

Signature

Date: 30 September 2020

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Abstract

ICT was introduced into education in the 1980s. Since then, it has brought and continues to bring, transformation in schools and in classrooms. One of the questions asked in this study is whether global skills, such as critical thinking, communication, collaboration, creativity and innovation skills, now seen as important 21st century skills, are taught in classrooms and if teachers are integrating ICT to teach 21st century skills. Teachers and education departments may focus on teaching ICT as a goal in itself and may not focus on the skills or competences that must be developed for the 21st century, and which can be developed using ICT. Even though research suggests that ICT can help students to learn more efficiently and teachers may use ICT to teach more effectively, studies conducted suggest that ICT will not make a difference by merely being used. This study aims to determine to what extent teachers teach 21st century skills with the integration and the use of ICT. Further to this, this study also attempts to determine how acquainted teachers are of 21st century skills, if teachers perceive themselves integrating 21st century skills in their own classrooms and teaching and finally attempts to determine if there is a relationship between teaching with ICT and obtaining 21st century skills. The findings concluded that even though teachers are aware of 21st century skills and are able to identify them, they do not use ICT to teach 21st century skills, but rather to enhance their traditional practices.

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LIST OF ACRONYMS AND ABREVIATIONS

2T2C	Thinking, Technology, Communication and Confidence
ATC21S	Assessment and Teaching of 21st Century Skills
CAPS	Curriculum and Assessment Policy Statement
FET	Further Education and Training band
ICT	Information and Communications Technologies
ICT4D	Information and Communication Technology for Development
KSAVE	Knowledge, Skills, Attitudes, Values, Ethics
NCS	National Curriculum Statement
OECD	Organisation for Economic Cooperation and Development
STEM	Science, Technology, Engineering and Mathematics
TPACK	Technological, Pedagogical, Content Knowledge
ZPD	Zone of Proximal Development

CHAPTER 1 – INTRODUCTION

1.1 INTRODUCTION

ICT refers to Information and Communication Technologies. Chen, Dominguez Castillo & Ligon (2015) defines ICT as using technology to gather, process and communicate information. This gathering, processing and communicating of information can be done using resources such as computers, software and the internet. Global skills; for example critical thinking skills, communication skills, collaboration skills and creativity and innovation skills, are some of the important global skills all students need to acquire to survive the 21st century (National Education Association, 2012). Education systems world-wide are moving towards teaching with ICT; however, the question remains whether teachers are perceiving themselves as teaching 21st century skills. Voogt and Roblin (2012) believe that schools should adjust their curriculum to develop students to be equipped for the 21st century. This research will examine whether teachers are using ICT to teach 21st century skills.

1.2 BACKGROUND TO THE STUDY

The early 1980s introduced Information and Communication Technologies (ICT) into education. One of the aims for the introduction was the hope that technology would transform the current education systems at the time (Karasavvidis, 2009). Olson (2000) argues that the traditional classroom consists of desks, chalk and chalkboards, books and maps. Teachers are comfortable with these technologies and have been using them to achieve their set learning goals. Thus, in this environment, integrating ICT into teaching may not be so easy.

South African students are from diverse backgrounds, languages and races. These differences cause huge inequalities in the student population of South Africa. South Africa prioritised education reform by making changes in legislation, policies, curriculum reviews and the integration of ICT in education delivery using the National Integrated ICT Policy (Department of Telecommunications and Postal Services, 2016). The Department of Basic Education in South Africa continues its attempts to set these inequalities right by policy implementation. One of the methods the government of South African believed would correct the inequalities was by initiating

ICT into teaching through the release of the White Paper on e-Education (Department of Basic Education, 2004). The aim was to transform traditional educational practices by supplying ICT resources to schools for use in the classroom. The goal was to force a change in curriculum delivery through policy.

The South African Education system and South African government (Department of Telecommunications and Postal Services, 2016) strongly encourages the integration of ICT into the current system of curriculum delivery and acquisition of knowledge and skills (Department of Basic Education, 2004). It is expected that this will improve the opportunity to use information and resources, accelerate learning processes, allow the use of different pedagogical ideas and improve overall educational outcomes. The White Paper on e-Education (2004) primarily aims to change the way teaching takes place through Information and Communication Technologies and change the way learning occurs. It states the purpose of the framework, clarifies the objectives, specifies the resources and spells out the strategies that should be used to implement ICT integration in the classroom.

It is expected that this change through the use of ICT will incite lifelong learning and provide an ICT environment to advance creativity, communication and engagement (Department of Telecommunications and Postal Services, 2017). The aim of the implementation of the policy is to transform traditional teaching and learning methods and force new ways of curriculum delivery. The expectation is that teachers should provide opportunities so that students can learn effectively through the use of ICT.

Investments are made by education departments to furnish classrooms with technology, and it is expected that academic achievement will increase (Department of Communications & Digital Technologies, 2020). Education departments, schools and teachers are thus focused on using ICT in the classroom, which changes the culture of teaching. The Fourth Industrial Revolution is changing how communication takes place, and therefore how we live and work. It is reshaping many aspects of life and forcing significant changes within education systems.

Technology has brought and continues to bring, transformation, but we need to look at how technology is used in the classroom and especially ask the question "What do we want students to learn?" and not necessarily "How do we want students to learn?" Allegra (2001) asks the question: "What is the role that Information Communication

Technologies are playing as cognitive tools in the classroom?" Teachers need to design and let students complete activities that support the acquisition of knowledge, force critical thinking, solve real-world problems, as well as use technology that can assist students to utilise the 21st century design thinking needed (Koh, Chai, Wong, & Hong, 2015).

Most schools in Gauteng have been provided with ICT in the classroom in various forms. This means that ICT resources are in use in schools as per White Paper 4 (Department of Basic Education, 2004). However, it is not clear if teachers are simply teaching using ICT resources or teaching 21st century skills.

Many schools and teachers regard being able to use ICT and learning the basic ICT skills as the core of education (Meenakshi, 2013). ICT resources are influencing schools and are believed to prepare students and teachers and give them more opportunities to enter the global market. This forces schools to aptly respond to these by teaching students to use of ICT. Furthermore, technology is constantly evolving and changing. Students use technology every day and it is therefore crucial for it to be included in their learning experiences.

The focus should, however, not be on access to ICT and to ICT related skills as goals in themselves but rather on skills like problem-solving, innovation, collaboration and creativity. The use of technology is a vital method to promote these needed skills but they should be integrated within a sound conception of education (Mishra & Koehler, 2006). Even though it is argued that 21st century skills can be acquired through the use of ICT (Ananiadou & Claro, 2009), Lewin and McNicol (2015) and Voogt and Roblin (2012) believe that these skills should be incorporated across the curriculum; additionally, pedagogical systems should be changed. Even though the uses of ICT are not the only way to develop 21st century skills, it has been found that technology-mediated teaching has been more effective in acquiring these skills (U.S. Department of Education, 2017).

Can utilisation of technology foster learning in the teaching space and enhance critical thinking, communication and collaboration, creativity and innovation? Answering this question will keep the attention on learning and not on technology integration.

The Organisation for Economic Cooperation and Development (OECD) released a report titled: "Students, Computers and Learning: Making the Connection" in 2015

which indicates that there is a need to effectively utilise technology during teaching to improve learning (Chenglie, 2017). This is also suggested by the White Paper on e-Education (2004).

Even though ICT improves access to education (Shan Fu, 2013), skills needed by students for the Fourth Industrial Revolution including creativity, innovation and problem-solving do not necessarily get taught by merely using ICT in the classroom. Brush, Glazewski and Hew (2008) stated as far as in 2008 that ICT is used as an instrument for students to access new topics, apply problem-solving skills and provide solutions to problems. This does not, however, guarantee the acquisition of problem-solving and innovation skills.

Global skills such as critical thinking, creativity, innovation, communication and collaboration, are all skills that are essential to students in the 21st century (National Education Association, 2012). Bourn (2018) points out that these global skills should be provided by schools.

Teaching and learning with ICT has developed over the years; however, many questions are asked about the efficient use of technologies. The utilisation of ICT allows teachers to present knowledge in different styles, but this may not improve students' deeper understanding of the knowledge if there is no inter-connection made between using ICT and acquiring 21st century skills (Department of Communications & Digital Technologies, 2020).

In a fast-changing world education should also be changing. Which student competencies or 21st century skills will be essential in the 21st century? Which teaching and learning processes are able to develop them? Which modules of assessment can empower students to acquire 21st century skills (Licht, Tasiopoulou, & Wastiau, 2017)?

Teachers and education departments may focus on teaching ICT as a goal in itself and not focus on the skills or competences that must be developed for the 21st century. Even though research suggests that ICT can help students to learn more effectively and allow teachers to deliver lessons more effectively, findings advise that ICT will not make a difference by merely being used as a teaching aid. Communicating with fellow students, resolving conflicts and disagreements, or attempting to solve a problem, are all skills necessary to achieve academic success (U.S. Department of Education, 2017). Increased access to ICT should assist the teaching of students so that they

become globally responsible citizens. The South African National Curriculum Statement envisages a student who can "access, and succeed in, lifelong education and training of good quality; demonstrate an ability to think logically and analytically, as well as holistically and laterally; and be able to transfer skills from familiar to unfamiliar situations" (Department of Basic Education, 2003, p. 15).

Teaching with technologies does not ensure the improvement of learning. To produce valuable learning using technologies, students should build efficient learning competencies and technological skills, and teachers should develop effective teaching and professional development competencies, and technological skills so that ICT improves learning outcomes (Pineida, 2011). Yildirim (2007) found that teachers use ICT mainly for the creation of notes and setting of tests rather than utilising it for problem-solving and critical thinking. He has concluded that external factors such as access to technology, shortage of time, insufficient support, as well as internal issues such as lack of confidence and belief in the advantages of the use of ICT all play a major role in the successful implementation of ICT in teaching.

The goal of transformation of education and teaching and learning practices has, according to the literature, not been obtained. Research indicates that technology is not used often enough to attempt to make a change; rather technology is added to existing practices instead of transforming them (Karasavvidis, 2009). When new ways of using technology are presented, its success depends on how it fits within existing ways. Can the way technology is used, foster learning in the classroom and enhance critical thinking, communication, collaboration and creativity? Asking these questions does not detract from the goal of learning; rather they move it from technology integration. Educational authorities have a responsibility to implement educational innovation and to discover how receptive teachers are about sharing and implementing innovation (Licht, Tasiopoulou, & Wastiau, 2017).

1.3 RATIONALE

The reason for this research is to try and determine to what extent teachers integrate teaching 21st century skills with the use of ICT. Many teachers seem to use ICT as the main resource to disseminate the necessary subject knowledge, and therefore do not plan, manage and integrate the important global skills of critical thinking, communication, collaboration and creativity during their teaching. The rationale of this

study is to establish whether teachers accommodate the global skills in their teaching practices. A lot of research regarding the integration of ICT to enhance 21st century skills has been conducted and has found that teachers still use traditional methods to teach (Hepp, Hinostroza, Laval, & Rehbein, 2004). A study done by Shear, Novais, Means, Gallagher & Langworthy (2010) proved that teachers do not integrate 21st century skills into their teaching in West Virginia (USA). This study aims to determine if this is the same in sample schools in Gauteng, South Africa.

1.4 RESEARCH QUESTION

To what extent do teachers integrate ICT to enhance 21st century skills in schools?

1.4.1 Sub-questions

1.4.1.1 How aware are teachers of 21st century skills?

1.4.1.2 How often do teachers perceive themselves integrating 21st century skills in their teaching?

1.4.1.3 What is the relationship between teaching with ICT and obtaining 21st century skills?

1.5 RESEARCH AIM

The goal of this study is to determine teachers' perceptions about whether they are integrating 21st century skills into their instruction using ICT. It will also investigate the frequency of the teaching of the 21st century skills like critical thinking, creativity, innovation, communication and collaboration.

1.6 THEORETICAL PERSPECTIVES

A theoretical perspective is a guide on which a study is built and supported and also provides the structure of how the study will be approached and what the study is theoretically based on (Grant & Osanloo, 2015). It forms a set of interrelated constructs that present a systematic view of a phenomenon or the manipulation of categories and the relationships among them (Anfara & Mertz, 2014). The theoretical perspective makes connections between the research problem, research questions, data collection, data examination and the analysis of the findings (Hughes, 2019). Theories ground the research and give the context against which key terms and concepts are defined.

A theoretical framework is based on an existing theory in a related field of enquiry. A researcher uses an existing theoretical framework to build his/her research. The theoretical framework in this study used a combination of the following: Zone of Proximal Development; the 2T2C Model, Technological Determinism and TPACK.

1.6.1 Zone of Proximal Development (ZPD)

The "Zone of Proximal Development" was introduced by Vygotsky (1978) who is the creator of the Zone of Proximal Development (ZPD) as a theoretical perspective. This perspective declares that a student can do what s/he does with the presence of assistance but actually alone (Silalahi, 2019). Vygotsky (1978) defines the ZPD as:

> "…the distance between the actual development level as determined by independent problem-solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (p. 86).

The ZPD concept proposes that in the course of learning, students face tasks or problems they cannot solve simply alone at first, but with assistance they are able to solve these eventually. Vygotsky (1978, p. 86) elaborates that the ZPD is important in the learning process because it states that "those functions that have not yet matured but are in the process of maturation, functions that will mature tomorrow but are currently in an embryonic state." If the ZPD is considered, it is assumed that students cannot learn without the assistance of human or technological resources. Teachers should be involved in teaching and students cannot learn 21st century skills with the use of ICT by themselves. This study accepts that teachers are the change agents for the teaching of 21st century skills with the use of ICT. Students need to be led to use ICT and learn the skills associated with it.

Vygotsky believes that development is a social process and that social interaction is necessary for social development (Silalahi, 2019). Silalahi (2019) believes that there will be consequences if ICT resources are used in children's learning. With the intervention of teachers these consequences can be decreased; however, six factors need to be present: assistance; mediation; cooperation; imitation, target and crises.

Even though ICT may improve the accessibility to information and thus improve learning, it does not on its own teach 21st century skills. Vygotski (1978) further states

that teachers are needed to move students from the known to the unknown, thus Vygotsky believed that children learn the best through the assistance of others. The 'others' are more capable and thus assist the child to develop to his/her maximum potential. This is the Zone of Proximal Development.

The Zone of Proximal Development supports using ICT in the classroom as an instrument for instruction which would assist with learning. The mere presence of ICT cannot teach the necessary skills without the teacher being present (U.S. Department of Education, 2017). Vygtosky's theory looks at how computers are embedded into a student's real life and how they help to advance student performance. Vygotsky's theory suggests analysing the interaction between a computer and its user and whether this tool and its characteristics are effectively used by students and teachers (Venenikina, 2010). This study aims to understand to what extent teachers integrate ICT to enhance 21st century skills in schools.

1.6.2 The 2T2C Model

The 2T2C model obtained its name from the four pillars of the model; namely, Thinking, Technology, Communication and Confidence (Warner & Jumani, 2016). The development of 2T2C took into consideration the need to prepare students for working in a global environment. At the core of the 2T2C model are its four pillars, thinking, technology, communication and confidence (Warner & Jumani, 2016) and these are the elements of 21st century skills being used in this study. The 21st century requires a student with the skills to be able to function well in a highly technological and dynamic world (Warner & Jumani, 2016). 2T2C has proven that it can assist in transforming a classroom to ensure students obtain creative, inventive and innovative thinking (including pedagogy and technology), to reach the skills and abilities required for a 21st century student (Warner & Kaur, 2017). The focus of this study is on 21st century skills and thinking, technology, communication and confidence are seen as important global skills that should be taught in classrooms. The 2T2C model aims to prepare students to obtain the skills required to function well in the 21st century.

1.6.3 Technological determinism

Technological determinism is defined by Dusek (2006, p. 84) as: "the claim that technology causes or determines the structure of the rest of society and culture." This

means that technology cannot be controlled. If technology has an influence on culture, society cannot affect the behaviour because of the use of technology (Hallström, 2020). Technology is independent of any external forces.

Technological determinism has the view that the presence of technology brings about the desired changes without any human input. This is opposite to the Zone of Proximal Development which believes that teachers are the main force behind ICT integration. An innovation like the integration of ICT into the teaching and learning methods aims to transform a traditional way of doing in education (Karasavvidis, 2009).

Technological determinism is the perspective that underlines the integration of ICT for South African schools in the White Paper (Department of Basic Education, 2004). This policy aims to transform, with the integration of ICT, how teachers teach. By implementing the policy, the policymakers have the view that teaching practices would automatically change by merely providing technology to schools (Department of Telecommunications and Postal Services, 2016). Hodgkinson-Williams (2006) states that there are many barriers to successful implementation, including limited access to resources, insufficient development of ICT skills for teachers and unreliable support. However, an innovation may not always be welcomed. Innovations introduced by authorities ignore the teachers' views, even if the innovation may prove to be beneficial to teacher practices. Teacher attitudes are an important factor to consider when attempting to integrate ICT into education (Karasavvidis, 2009).

1.6.4 TPACK

Mishra and Koehler (2006) created TPACK (Technological, Pedagogical, Content Knowledge) which emphasises that what teachers know about good teaching, their subject content and technology, must be used collectively to successfully support student learning.

TPACK is divided into the types of knowledge (Mishra & Koehler, 2006) and is also shown in Figure 1.1 below:

- Content Knowledge (CK) – This explains what teachers know about the subject.
- Pedagogical Knowledge (PK) – This explains what teacher know about the aims and purpose of education through awareness of learning styles, classroom management systems, preparation, presentation and assessment.

- Technological Knowledge (TK) – This explains a teacher's ability and what they know about technology, software and resources.

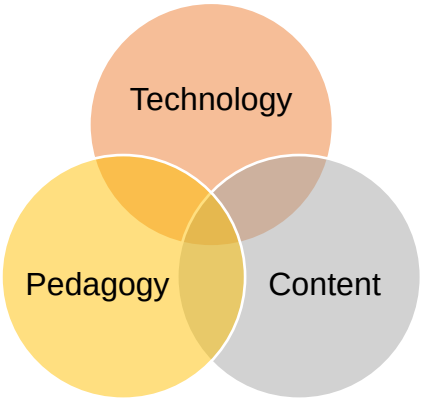

Figure 1.1: TPACK

The aim is to create a favourable relationship between the three subsets to ensure effective teaching. This study focuses on the integration of ICT in teaching, and whether 21st century skills are integrated into content and pedagogy. By differentiating between these three, technology, pedagogy and content, the TPACK framework summarises how content (the subject knowledge taught) and pedagogy (the approach the teacher uses) must form the basis for successful ICT integration to enhance learning of 21st century skills.

The TPACK model aims for a perfect balance between pedagogy, content, and technological abilities for educators to provide the most successful learning experience (Mishra & Koehler, 2006). TPACK is a framework depicting the knowledge teachers should have to be able to integrate ICT into teaching and how this knowledge can be developed (Liviani, 2020). There are various other challenges and limitations, besides knowledge, that hinder the successful integration of technology in the classroom. Even though TPACK paints an ideal situation, teachers should be well informed and be able to identify goals, choose a way to demonstrate content and match the most appropriate technological tool to achieve the goal (Liviani, 2020). The problem with how TPACK is understood is limited by the focus of the teacher. The focus could be on pedagogy, content, or technology. This study focuses on the teaching of ICT skills with the help of technology which desires a balance between the three competencies for the successful implementation of TPACK.

1.7 DEFINITION OF KEY TERMS

Table 1.1: Key terms

ICT	Chen, Dominguez Castillo & Lagon (2015) defines ICT as using technology to gather, process and communicate information. The gathering, processing and communicating of information can be done using resources such as computers, software and the internet.
21st century skills	The term refers to certain fundamental skills such as critical thinking, collaboration, communication, creativity and innovation that education leaders suppose schools should teach to assist students to succeed in a modern world (Bourn, 2018).
Critical thinking	To be able to analyse, interpret with precision and accuracy, problem solve and reason (Conley, 2008).
Collaboration	To be able to work individually as well as in teams, face-to-face as well as virtual (National Education Association, 2012).
Communication	To be able to articulate oneself clearly, expressing an opinion and communicating clear instructions, thus being able to interact and share information in a variety of ways (Conole & Dyke, 2004).
Creativity and Innovation	To be able to have creative thinking skills and provide innovative solutions to a global problem (Department of Communications & Digital Technologies, 2020).

1.8 RESEARCH DESIGN

This research followed a positivist belief that knowledge is determined as derived from statistics through empirical evidence (Rehman & Alharthi, 2016). This will be further discussed in Chapter 3.

In this research, a quantitative research approach was used. Quantitative data was used to quantify the research problem into quantifiable statistics. A questionnaire was used and scores were allocated to responses (Chiang, Jhangiani, & Price, 2015).

The strategy for this research was survey research. For the purpose of allowing a large number of individuals to participate, an online questionnaire was used.

1.9 AN OVERVIEW OF THE CHAPTERS

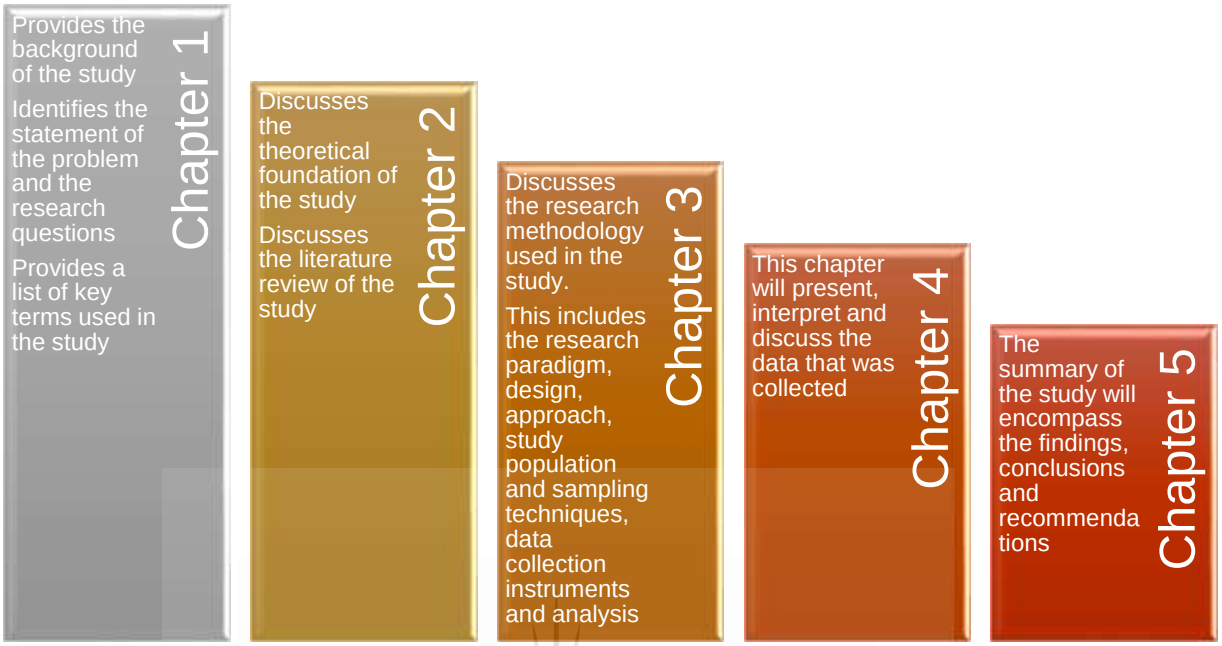

Figure 1.2: Overview of Chapters

CHAPTER 2 – LITERATURE REVIEW

2.1 INTRODUCTION

A literature review is an assessment of prior research in any study field (Bhattacherjee, 2012). The importance of related literature cannot be denied in any research. It guides future research, not only to identify gaps, but also to critically assess similar or related studies and attempt to address the gaps presented. Figure 2.1 depicts the various purposes of a literature review.

The purpose of a literature review:

Figure 2.1: Purpose of a Literature Review (Adapted from (Snyder, 2019))

To answer the research question "*To what extent do teachers integrate ICT to enhance 21st century skills in schools?"* literature was reviewed to establish the importance of integrating ICT usage in schools, the effectiveness of ICT integration and if 21st century skills are taught.

Figure 2.2 provides an outline of this chapter:

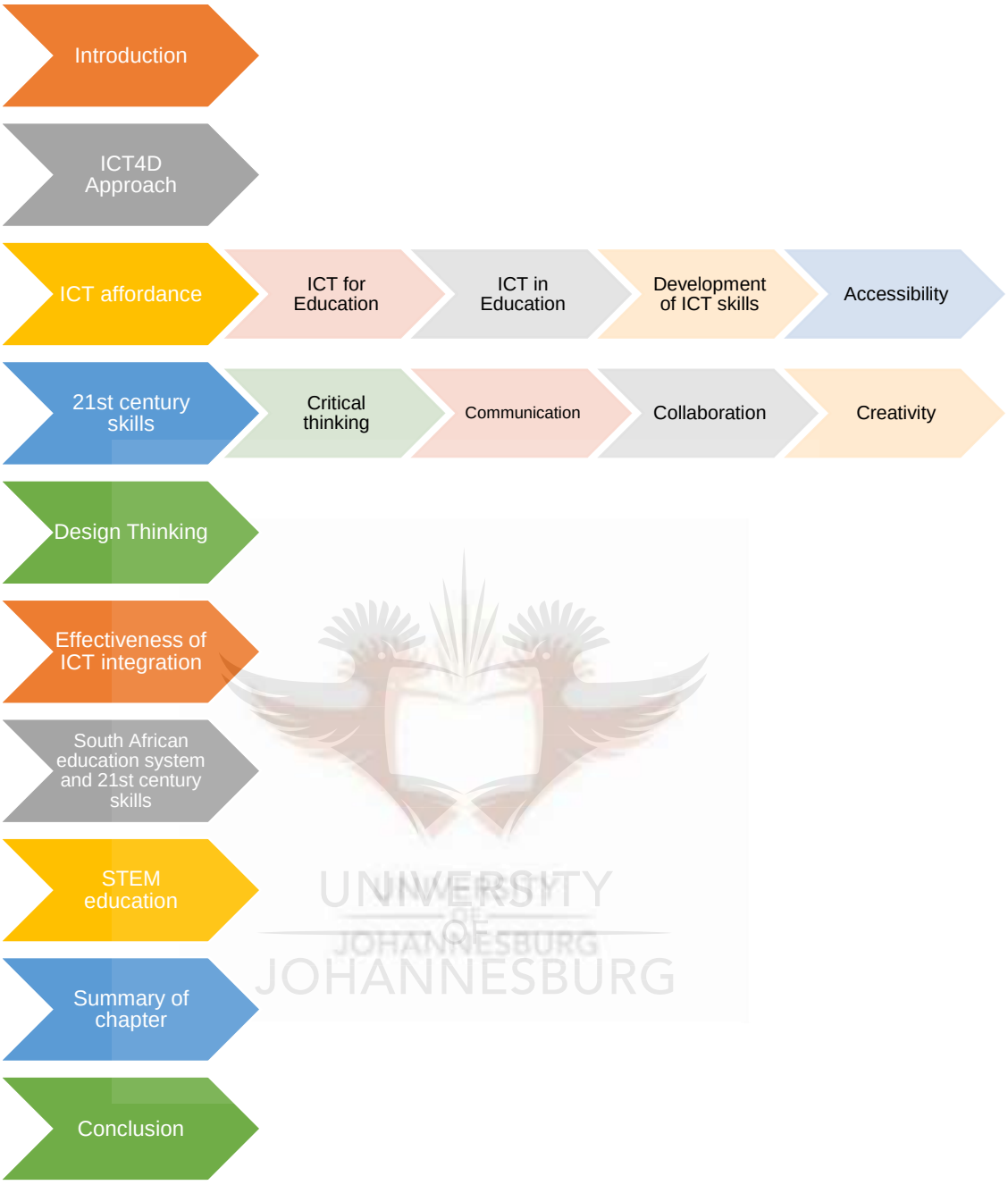

Figure 2.2: Outline of Chapter 2

2.2 ICT4D APPROACH

The ICT4D ("Information and Communication Technology for Development") field is "strongly interdisciplinary and draws upon fields such as development studies, information systems, computer science and a large number of other disciplines" (Zheng, 2015, p. 25). The ICT4D (ICT for development) approach has been developed since the 1990s, and theorises that ICT resources can be used as a tool for

development and recognises the role of ICT in teaching. This approach surfaced because of the integration between the availability of the internet and the Sustainable Development Goals (United Nations Development Programme (UNDP), 2016). ICT tools were primarily viewed as the only tools for delivery and change but later became more integrated into developmental strategies and plans as a secondary tool. ICT for development (ICT4D) is a paradigm that occupies researchers, not only in computer sciences, but also in humanities (Heeks, 2009). Many research projects include ICT as the basis for the project, and as such an approach is needed that includes ICT for development. ICT4D is an approach that would merge technology and the humanities. The ICT4D approach leans positively towards the epistemology that suggests that reality is out there to be discovered (Heeks, 2009).

2.3 ICT AFFORDANCE

'Affordance' refers to how a specific thing (or device) could feasibly be used (Salomon, 1993, p. 51), also stating the various possibilities of how ICT can be used in different contexts of teaching and learning. An affordance according to Hammond (2010) is a relationship between a person and an item and the item is perceived in relation to the wants of the person. An affordance views both ways, to the item and to the user. An affordance is a possible way the object can satisfy the need of the person. However, the affordance should be perceived first before it can be realised (Hammond, 2010). There are many affordances of ICT that could satisfy the needs of students.

2.3.1 ICT for education

Amin (2013) states that using ICT for education practice is divided into: "ICT *for* Education" and "ICT *in* Education". ICT for education suggests the promotion of ICT skills during teaching and learning. The change in learning has forced a speedy increase in online learning environments (Conole & Dyke, 2004). New online learning tools were developed to support learning and research as well as facilitate the vast amount of information. There has been an increase in the range of resources developed to assist learning and teaching. When it comes to searching for information and being able to handle this huge amount of information, the sheer volume is increasing exponentially, whilst the searching and handling tools do not match the demand. Critical thinking, research, and evaluation skills are becoming more important

as students have to deal with large amounts of information from many sources (National Education Association, 2012).

Conole & Dyke (2004) argue that ICT has multiple affordances and a clear formulation of the affordances of ICT. This would allow us to understand how ICT can be used efficiently to support learning and teaching. Technologies can be used in various systems to support teaching and learning, and the devices and sources available have increased significantly. There has been an enormous evolution in the utilisation of technology, promoted by the development of software such as learning management systems.

ICT, according to Amin (2013), has many affordances, including innovation, enrichment, and deepening of skills. ICT is seen to have the ability to improve results, teaching, management, and develop global skills needed in the Fourth Industrial Revolution. The use of ICT may raise collaborative learning, presuming that no intervention from any teacher is needed (Amin, 2013).

Current ICT tools can have a positive or negative effect on the users. These advances have been met by very different opinions, from enthusiastic reception and demands for pedagogical change and transformation of educational goals, to considerable opposition and scepticism about these new applications (Conole & Dyke, 2004).

2.3.2 ICT in education

ICT in education involves the use of ICT in teaching learning process (Amin, 2013). ICT tools offer the opportunity for teachers to make their teaching more connected to the real-world by using multi-media (De Sousa, 2017). As students find the classes more interesting, the content remains in their memories for a longer time span, and is more easily accessed during examinations. The implementation of ICT in education, therefore, proves to have a positive effect on teaching and learning. ICT could provide an incentive for teaching and learning and this positive effect on learning would present new opportunities for students and teachers (Amin, 2013). These opportunities can have an encouraging effect on student attainment. Research has shown that the effective use of ICT can shift the heart of education to content and pedagogy and this can reform education to fit the 21st century (Amin, 2013).

Pineida (2011) agrees that ICT tools have the possibility to:

- Motivate and engage students;
- Ensure that students experience real-life situations in their school experiences;
- Create global citizens; and
- Strengthen teaching and help schools become change agents.

The White Paper on e-Education in South Africa (Department of Basic Education, 2004) acknowledges that ICT tools are key to the developments taking place in the world and that technology plays a vital role in changing teaching and learning. This forces new opportunities and will provide access to additional educational resources.

The South African Department of Basic Education (2004) expects students to become lifelong students and grasp possibilities for personal growth and advancement. South African education managers focus on the use of ICT to accelerate the attainment of national education goals. The aim of South African education is to connect students and teachers for continuous training and aims to provide programmes for learning. ICT is expected to advance innovation in teaching through the effective balance between pedagogy and technology. It will support larger systemic, educational, curricular and assessment developments that will improve education and the use of instructive material. The mere use of ICT should, according to the White Paper (2004), improve higher order thinking skills; for example, innovation, problem-solving and reasoning. Moreover, communication, social skills, public speaking, cooperation, and productivity skills, including creating superior products, will improve. These are all expectations listed in the White Paper (2004).

2.3.3 Development of ICT skills

ICT will provide benefits beyond improved computer mastery and skills. It would advance the ability to (Department of Basic Education, 2004, p. 14):

- "Apply ICT skills to access, analyse, evaluate, integrate, present and communicate information;"
- "Create knowledge and new information by adapting, applying, designing, inventing and authoring information;" and·
- "Function in a knowledge society by using appropriate technology and mastering communication and collaboration skills."

The assumption that access to ICT will force improved problem-solving skills, creativity and innovation may be flawed. The South African Education Department believes that teacher interventions may be necessary to achieve all the aims set by the White Paper (Department of Basic Education, 2004). These affordances are achievable, not by only providing ICT to schools, but also by providing the necessary goals that using ICT should achieve.

The U.S. Department of Education (2017) agrees with the South African Department's aims that ICT can be a forceful instrument to transform learning. ICT can help support and improve interactions between teachers and students, renew approaches to learning and cooperation, decrease the digital divide, and adjust learning practices to meet the demands of all students.

Global education departments agree that teachers need to use technology efficiently in their teaching. "When carefully designed and thoughtfully applied, technology can accelerate, amplify, and expand the impact of effective teaching practices" (U.S. Department of Education, 2017). Educators need to be trained to have the needed expertise and abilities to be able to successfully use technological learning environments. The U.S. Department's conversations have shifted from the use of technology during teaching to how it can be used to improve learning (U.S. Department of Education, 2017). The South African Education Department needs to incorporate learning with ICT as an aim, not only having access to ICT.

2.3.4 Accessibility

Conole & Dyke (2004) states that even though technology has many affordances, poor design of devices often restricts ease of use for users. He supposes that better design of devices would make it easier to complete certain tasks. However, even if the design of devices improves and accessibility is taken into consideration, many still do not know *how* ICT tools can be used appropriately. The use of technology is based on acceptance by people rather than how technology will improve pedagogy. There is evidence of a gradual realisation that the use of these technologies within education can be advantageous (Conole & Dyke, 2004). Research shows that it is difficult to provide reliable computer-generated learning or collaboration.

The question as to whether knowledge and insight of these affordances can be used to improve teaching and learning is answered by creating a taxonomy for these

affordances (Conole & Dyke, 2004). This makes it possible for users to make educated decisions about how these technologies can be used.

2.4 21ST CENTURY SKILLS

Older education systems focused on reading, writing and numeracy. Nowadays, education systems regard ICT, elementary skills and beliefs of ICT as part of the essence of education (Amin, 2013). Technology and the application thereof, becomes more important in society and this leads to the need for global skills. The world is digitising itself, and the role ICT plays in education is more prevalent and this will increase and expand in the 21st century (Department of Communications & Digital Technologies, 2020).

All education systems should have a common goal: "All students will have engaging and empowering learning experiences in both formal and informal settings that prepare them to be active, creative, knowledgeable, and ethical participants in our globally connected society" (U.S. Department of Education, 2017, p. 9). The aim should be to develop globally skilled and responsible citizens. Schools must combine 21st century skills, including critical thinking, innovation and creativity, collaboration and communication skills, into the delivery of all subjects. Human resources needed for planning and implementing the necessary 21st century pedagogies should not be ignored (Mynbayeva, Sadvakassova, & Akshalova, 2017).

ICT can be used to achieve successful teaching of 21st century skills, but not in isolation. Human and digital resources are needed. ICT can help students learn from real-world challenges – using wide-ranging digital devices and tools to show capability and performance. Blogs, online video streams and real-time research are some ways to step closer to the education of 21st century skills (Boholano, 2017).

Care, Griffin and Wilson (2018) explore the world-wide shift to information- and technology-driven systems. Changes in economies demand shifts in education and subsequently teaching and learning. Shifts in education systems would force curricula to change. Curricula should encompass lifelong learning approaches to education. For lifelong learning to be emphasised, education needs to be modernised. Education should be coaching students for responsibilities that do not yet exist and will not last long, since technology is changing rapidly. The workplace is expected to be digitised in future and technologies that have not even been invented yet, will be used.

Care, Griffin and Wilson (2018) claim that citizens will live in certain ways where the required type of thinking and learning does not yet exist. Due to the digital explosion, people should leave schools with skills, attitudes and values appropriate for an information age. Care et al. (2018) agree that the workplace demands creativity, critical thinking, problem-solving and decision making. Teamwork skills should be developed using currently available new tools. Workplace borders will not exist which will encourage collaboration and sharing of information. The more advanced the world becomes; the more these skills are necessary. Students need to master the ability to solve problems by identifying patterns and making connections. The aim is to create active, responsible and global citizens who have the necessary 21st century skills (Gijsbers, 2012).

Since the release of the Sustainable Development Goals (United Nations Development Programme (UNDP), 2016), the proposal for the development of a broader curricula has been recognised. Sustainable Development Goal four requests skills beyond reading ability and mathematical ability – incorporating skills for worldwide social conscience and environmental growth. The international conversation has moved to a concern for global social conscience and worldwide expertise. These concepts are underpinned by the teaching of 21st century skills.

The "Assessment and Teaching of 21st Century Skills" (ATC21S) (Griffin, McGaw, & Care, 2012) project was created by commercial organisations because of concerns that future workforces who would require 21st century skills in workplaces, were not being taught these. The ATC21S project summarised these skills (Binkley, Erstad, Herman, Raizen, & Ripley, 2009, p. 170) and divided them into four categories:

- "Ways of Thinking: Creativity and innovation, critical thinking, problem-solving, decision making; learning to learn, metacognition;"
- "Ways of Working: Communication, collaboration (teamwork);"
- "Tools for Working: Information literacy – including research on sources, evidence, biases, etc., ICT literacy;" and
- "Living in the World: Citizenship – local and global; life and career; personal and social responsibility – including cultural awareness and competence."

Binkley, Erstad, Herman, Raizen and Ripley (2009) are concerned that without detail in planning, the 21st century aims and objectives are implausible unless demonstrated

in the actual learning of students. They suggest that curricula should be designed and re-designed to reflect successful teaching and acquiring of 21st century skills.

ICT in learning may support knowledge construction. Research claims that students may start to attain the crucial 21st century skills that may be essential in their lives (Amin, 2013). This assumes that 21st skills are automatically acquired whilst ICT only provides new educational approaches. The assumption further supposes that by merely using ICT in education, higher order thinking skills such as collaboration, are assimilated. ICT can help strengthen students' content knowledge, forcing them to construct their own knowledge and encourage the acquisition of higher order thinking skills (Kozma, 2011). Defining and teaching 21st century skills will need a system of change. Planning systemic curriculum development and implementation will increase the opportunities for the effective employment of the necessary skills in education.

The KSAVE model (Binkley, Erstad, Herman, Raizen, & Ripley, 2009, p. 184) offers teachers and students a defined collection of aims that students should achieve when they master one or all of these necessary skills:

- "Knowledge (K): the required knowledge or understanding for each of the skills;"
- "Skills (S): the required abilities and processes for each skill;" and
- "Attitudes/Values/Ethics (AVE): the behaviours and aptitudes that students exhibit for the skills."

A renewed curriculum in the classroom should reveal a balance between knowledge and competences traditionally respected and competences that are currently considered necessary in society (Care, Griffin, & Wilson, 2018). For school management teams and teachers, the question of deciding which approach would be best when including 21st century skills in the curriculum and in classrooms, is raised.

For successful implementation Voogt and Roblin (2012) suggest that one of following three approaches can be used:

a) 21st century skills may be included into the existing curriculum as innovative subjects or as additional areas within existing subjects;
b) 21st century skills can be integrated to overlap curriculum skills that support the existing subjects in the curriculum and emphasise the achievement of broader important competences; or

c) 21st century skills can become introduced as a new curriculum where out-dated structures are transformed.

Moreover, 21st century skills should be linked with subjects in the curriculum since they cannot be taught in isolation. An important aspect to consider is that students need to see patterns and identify relationships between concepts and subjects, instead of just recalling facts.

A mistake schools and teachers make is thinking that education in the 21st century consists of traditional teaching methods expanded by teaching with ICT tools (Ghavifekr & Rosdy, 2015). Teachers may consider 21st century skills as additional to their already full curriculum and may therefore perceive ICT tools as distracting them from their subject-related goals and objectives. Fears from teachers include time constraints and how the teaching of 21st century skills will be distributed across subjects.

No guaranteed instructions for successful integration of 21st century skills into the curriculum exist, but Nieveen and Plomp (2017) recommend five principles for the change process:

- Implementation is a learning process for all, both teacher and student;
- Implementation requires autonomy within borders;
- Implementation requires sufficient time to develop;
- Implementation consists of small steps to success; and
- Implementation needs to consider the old methods and encouragement new methods.

It is clear that teachers should make a lot of effort to integrate ICT and 21st century skills into teaching; however, encouragement and support for students to adopt active learning are additionally needed to obtain these skills (Ghavifekr & Rosdy, 2015). Learning processes must be designed to ensure students learn – with help from their teachers – how to be the masters of their own learning process.

Pineida (2011) agrees with Anderson (2008) that the mere use of ICT in the classroom would not promise improved performance. The focus has been on providing schools with ICT tools without making an effort to develop the necessary skills surrounding the use of these. Gauteng has delivered tablets and whiteboards to schools; however, theft, lack of skills and poor maintenance has caused challenges during

implementation and therefore the teaching of 21st century skills is not taking place despite the availability of resources.

Nevertheless, if teachers recognise technology as a crucial aspect in the teaching of 21st century skills and apply their own innovative skills, the required competencies will be taught. This is essential for how teachers and students can include ICT as an educational method (Ghavifekr & Rosdy, 2015). Learning in the current century is different from that in previous centuries, and teachers are forced to adapt technology to their teaching habits.

For learning outcomes to improve with the use of ICT, students should obtain technological and learning competencies. Teachers should obtain instructional, specialised, and technological competencies. This will assist students to become lifelong students (Pineida, 2011).

Many teachers do not apply 21st century skills at all. They teach alone in isolated classrooms. No collaboration to evaluate their teaching methods takes place, or bringing in alternative outlooks, discussions of modern ideas, giving feedback to improve efforts. To overcome their normal remoteness, teachers should work together. Teachers need to set an example of using the 21st century skills they are trying to encourage (Care, Griffin, & Wilson, 2018).

The Department of Communications & Digital Technologies (2020) encourage the promotion of new ways of teaching and learning. There is a prospect of investigating new opportunities for improving higher order thinking skills. The Department of Communications & Digital Technologies (2020) also agrees that the integration of higher order and metacognitive skills should be included into instruction and evaluation. Assessment could be used informally to steer the design of tasks and provide a tool to track the forward moving trends that may occur because of the use of ICT to assist learning and teaching.

Bourn (2018) agrees that students need to participate in worldwide challenges, such as climate change and impoverishment, to be more educated and involved citizens. Research shows that 21st century skills equip students with skills and abilities to work in a worldwide culture. Bourn (2018) further asks the question whether a school curriculum should be knowledge-centred or skills-centred, whether students should learn competence, the ability to perform tasks or skills to perform tasks.

> The Education 2030 Agenda and Framework for Action (2016, p. 21) expects "education systems to ensure that all students are provided with the knowledge and skills to promote sustainable development, including education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of cultural contribution to sustainable development" (United Nations Development Programme (UNDP), 2016).

Scott (2015) expects schools to rethink their pedagogy for the 21st century and not only focus on identifying competencies. Complex thinking skills require students to engage in a query-based culture that provides significance for themselves and their societies.

How can students be assisted to develop 21st century skills? People learn in many different ways and teachers are responsible for determining which methods help which students learn most successfully. Research indicates that some types of pedagogy are more advantageous in supporting students to obtain a deeper sense of 21st century skills. Pedagogies that would assist deep learning include personalised learning approaches, cooperative learning and comfortable learning (Gijsbers, 2012; Leadbeater & Wong, 2010). Local connections are defined as "being able to apply what they have learned to local contexts" (Hixson, Ravitz, & Whisman, 2012, p. 8).

Saavedra and Opfer (2012) claim that students must improve their own skills and develop their own learning so that they are able to solve global problems. Even though the focus is on skills like critical thinking and communication, innovation and problem-solving through negotiation and cooperation, pedagogy has not changed to focus on these challenges. This happens, even if ICT tools are available in classrooms. As argued by the authors, this shows that student-centred learning is needed.

Even though it is commonly known that 21st century capabilities and skills are difficult and tough to teach, Saavedra and Opfer (2012) claim that students do not build these capabilities and skills by themselves, and they only acquire these when they are specifically taught. However, including them in traditional subjects may not prove to be effective.

Darling-Hammond (2020) reasons that the effective redesigning of educational structures is dependent on transforming instruction and reforming learning tasks.

Technologies can be used to transform pedagogy, but it is essential to recognise that 21st century learning experiences must incorporate more than just the use of technology.

Darling-Hammond also stresses that learning approaches are not restricted to schools, but will include learning through friends, relationships and communities. The current education system is disintegrated, and the needs of students are ignored because students shift from one educational structure to another and from one school to another. As there is often no correlation between different schools, education should therefore focus on each students' own personal learning journey (Leadbeater & Wong, 2010). Education should teach students on a more personal level. Technology according to Leadbeater and Wong (2010), should support learning rather than being the focus of learning.

From the time when a global movement was discovered, a new model of teaching for the 21st century became necessary, which means education should be altered to allow new ways of learning that are needed to confront difficult global problems. Leadbeater (2010) agrees that pedagogies need to change. Moreover, the question of how to teach these skills effectively is ignored. The traditional instruction model has been proven unsuccessful for teaching 21st century skills, but teachers still use it. Despite understanding that students need global skills, pedagogy has rarely changed to focus on these problems. Reconsidering pedagogy in the 21st century is as important as recognising new capabilities that current students need. The need for a new knowledge model cannot be separated from the equitable distribution of knowledge.

Rethinking pedagogy needs to (Leadbeater & Wong, 2010):

- Reintroduce the focus on quality;
- Promote involvement and sharing;
- Customise learning;
- Emphasise project-based learning;
- Boost partnerships and communication;
- Involve and inspire students;
- Nurture creativity and innovation;
- Utilise new learning instruments;
- Design appropriate and real-world knowledge activities;

- Instil metacognitive abilities;
- Develop the most appropriate connections for learning;
- Unite every student with technology;
- Focus on learner-centred styles;
- Promote learning anytime and anywhere;
- Persuade students to be lifelong students;
- Measure deeper understanding and expertise; and
- Redefine teacher roles and functions.

All teachers want their students to be successful and engaged citizens. While several years ago, successful teaching meant that students learnt reading, writing and arithmetic, this is no longer the case.

Students today are competing globally. Global demands have changed and new challenges are faced daily; challenges like climate change, epidemic diseases and financial challenges. For students to deal with the global demand and to become engaged citizens, 21st century competencies and expertise should be evident and merged throughout their learning experience (U.S. Department of Education, 2017). Global connections are defined by the University of Birmingham (2007, p. 2) as " those skills that enable us to operate in an international context. These skills include cultural awareness, language and communication skills, international commercial awareness and networking." Teachers should incorporate all the subjects they teach with 21st century competencies including critical thinking, communication, collaboration and creativity. For the sake of this study, the following 21st century skills are discussed: critical thinking, communication, collaboration and creativity (National Education Association, 2012).

The National Education Association (2012) in Washington agrees with the South African Education Department (Department of Basic Education, 2003) that it is our duty to groom students for the pressures of the 21st century. Skills needed by the job market continuously change dramatically. Future jobs require capabilities such as critical thinking, innovation and the capacity to interact with different cultures. Every student should not only master critical thinking, communication, collaboration and creativity, but also master content. The National Education Association (2012, p. 2) developed the concept of the Four Cs ("critical thinking, communication, collaboration,

and creativity") and believe that they should be built into education. If today's students want to be competitive in this global technological culture, they must be skilful critical thinkers, communicators, collaborators and inventors (National Education Association, 2012). The Four Cs need to be incorporated into classrooms and schools to prepare students of today to become global citizens (National Education Association, 2012).

2.4.1 Critical thinking

Without thinking, learning does not happen. In a study led for the Bill and Melinda Gates Foundation, David Conley (2008, p. 5) observes that "habits of mind" such as "analysis, interpretation, precision and accuracy, problem-solving, and reasoning" are more valuable than having knowledge about content. The definition of critical thinking skills taken from the University of Louisville (2020, p. 1) explains critical thinking skills as "… the ability to analyse information objectively and make a reasoned judgment. It involves the evaluation of sources, such as data, facts, observable phenomena, and research findings."

Students of today must be critical thinkers since they need to assess data, evaluate information, and make decisions. In the current technological age, students need to be able to sift through a massive amount of information about global warming, economic growth and many other topics to formulate solutions. Finding solutions to global problems necessitate well developed critical thinking skills. Teaching critical thinking and problem-solving effectively in the classroom is vital for students (Department of Communications & Digital Technologies, 2020).

2.4.2 Communication

Education has traditionally focused on confident reading, correct language, and clear writing. Expressing yourself clearly, articulating your opinion, communicating clear instructions and motivating others are skills appreciated in the workplace. In current times, skills like these have been renewed and are becoming more important every day.

Students should be able to efficiently analyse and process the vast amount of information available to them. They must be able to determine what information is accurate, what is not and how to communicate the information effectively. The Collins

Dictionary (2020, p. 101) describes communication skills as "the ability to convey information and ideas effectively."

"Students must be able to communicate not just with text or speech, but in multiple multimedia formats. They must be able to communicate visually through video and imagery as effectively as they do with text and speech" (Hepp, Hinostroza, Laval, & Rehbein, 2004, p. 57).

2.4.3 Collaboration

Many years ago, most work was completed by individuals working in isolation. Now, most of the work is completed collaboratively, and teams are made up of global members.

Collaboration means that students demonstrate the ability to work "effectively and respectfully with diverse teams, they exercise flexibility and willingness to be helpful in making necessary compromises to achieve a common goal" (Licht, Tasiopoulou, & Wastiau, 2017, p. 165). The National Education Association (2012) defines collaboration skills as being able to work with others and communicate effectively.

Students must be able to collaborate in face-to-face and online spaces, with real and virtual people worldwide. Collaboration is vital in schools because it is fundamental to how work is completed (Pineida, 2011).

2.4.4 Creativity

Daniel Pink states that "the future belongs to a very different kind of person with a very different kind of mind—creators and empathisers, pattern recognizers and meaning makers. These people will reap society's richest rewards and share its greatest joys." (Pink, 2009) (para. 1). If students exit schools not being able to generate and innovate, they will not be prepared to solve the global questions of society and the workplace.

In today's global race and computerisation, innovation and creativity are becoming requirements for success. Students must think critically and produce creative outputs in a technological and non-technological setting to provide exclusive and practical solutions. Creativity is defined by Zhou and Purushothaman (2018, p. 24) as "creativity means to develop new and useful ideas."

Allegra, Chifari and Ottaviano (2001) emphasised creative thinking many years ago and how it can be inspired through the usage of ICT in teaching. This requires ICT tools being used as cognitive tools in the classroom. Creative thinking is not only concerned with content but with procedure. Thinking processes involved in each subject must be enhanced didactically to develop creative thinking. A computer cannot be used as a cognitive tool without the human factor. Technology should not be used only to support learning and teaching. Technology gives students the opportunity to capture, analyse and present information, sharing it with others. By doing this, they obtain different skills, including communication, and practical, semantic, literal and intellectual skills. It should be noted that the use of ICT does not automatically allow for the skills above to be developed; rather, ICT should be coupled with the teaching of 21st century skills.

Kenneth Robinson, an important thinker and presenter creativity said, "Creativity is as important in education as literacy and we should treat it with the same status." To nurture a creative mind we need an education that contains "exploration, challenging problems, and the tolerance, if not active encouragement, of productive mistakes" (Robinson, 2011).

2.5 DESIGN THINKING

"In the fast-paced knowledge economies of today, workers are constantly confronted with complex problems that require them to engage in the design of innovative solutions" (Koh, Chai, Wong, & Hong, 2015, p. 5).

Critical competencies needed are the skill to probe into difficulties; generate knowledge of positions and create innovative solutions (Department of Communications & Digital Technologies, 2020). New pedagogies need to be explored, redesigned and structured and design thinking is necessary to achieve this. An evaluation of current pedagogies for a new design thinking in education is needed. Efforts should be made to create new pedagogies suitable for the age of fast technological improvement. Knowles (1975, p. 18) defines self-directed learning as

> "… a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and

implementing appropriate learning strategies, and evaluating learning outcomes."

Koh et al. (2015, p. 12) believe that "education should pay attention to the design and embed design thinking as an integral part of education." Nurturing design thinking is vital in the information period, guided by technology. Design thinking pursues the utilisation of knowledge and ways to discover feasible answers to connect the desires and interests of people (Koh, Chai, Wong, & Hong, 2015).

Teacher education needs to be transformed to produce knowledgeable and skilful future teachers that can work creatively to develop ideas for continuous teaching progress. Future teachers must be trained in design thinking skills to be able to design lessons to accomplish the educational objective of nurturing 21st century capabilities. Design thinking forces students to design solutions for real-world problems, think critically and engage in metacognitive processes. Design thinking places students in environments that expect them to display the 21st century skills required (Koh, Chai, Wong, & Hong, 2015).

Educational organisations should strengthen the link between knowledge of content, design thinking, and 21st century competencies. This will ensure that teachers teach content, thinking and competencies needed to succeed as global citizens (Koh, Chai, Wong, & Hong, 2015).

2.6 EFFECTIVENESS OF ICT INTEGRATION

Despite the development that has been made in teaching with ICT tools, many questions are still asked about the efficient use of ICT (Chenglie, 2017). How would distraction from students be managed? Will ICT negatively affect students? Will students become dependent on ICT's when solving everyday problems? How can inaccurate feedback that leads to incorrect interpretation be managed? Can students use ICT for learning? How can digital learning environments be designed? Are there pedagogies that exist that blend ICT tools to support effective learning? How would ICT assist students that have diverse learning habits and abilities?

Hepp, Hinostroza, Laval and Rehbein (2004) state in their paper "Technology in Schools: Education, ICT and the Knowledge Society" that ICT tools have been utilised in schools, but not in all South African schools. This is still the case today. Not all

schools have ICT available for teaching and many teachers are still using traditional methods. Conventional teaching has emphasised the memorisation of content. The only conventional resources available are textbooks and blackboards, and teachers have taught through the lecturing method followed by activities that were designed to practise content. However, technology has become the central point of learning in the workplace and schools should prepare students for a digital era. Ghavifekr, Afshari and Amla Salleh (2015) agree that the use of ICT should be integrated into school curricula.

Modern schools are now emphasising curricula that encourage ability, performance and capabilities such as how information is used against what the information is. ICT tools are used as information sources and cognitive tools. ICT may provide support for student-centred learning that focuses on competency and performance (Amin, 2013). ICT impacts what students should learn, but also on how the students should learn. Curriculum has moved from "content-centred" to "competence-based", the method of core curriculum delivery has now changed from "teacher-centred" to "student-centred".

The aim of ICT integration is to improve and increase the quality of teaching and provide access to a variety of resources. The use of ICT will lead to efficient learning with the help of ICT resources and tools.

The following are more specific aims of ICT implementation in education (Meenakshi, 2013):

1. Life-long learning;
2. Use of a variety of educational services;
3. Equal chances of obtaining skills and information;
4. Collection and dissemination of educational information; and
5. Technological literacy.

Ghavifekr and Rosdy (2015) indicate that teachers' views on the usefulness of integrating ICT to assist teaching and learning processes in the classroom will influence successful implementation. For successful implementation, teachers must grasp the pedagogical role of ICT, and use it meaningfully in their teaching. However, some teachers lack confidence in the use of ICT tools and avoid using them. A major barrier to implementation is teachers' belief. Teachers should believe that the

incorporation of ICT into their teaching is important as it will help students develop collaboration skills that will encourage social skills, problem-solving, independence, accountability and innovation. Resistance to change and thus, technology, is a complicated process. Teachers need to adjust and therefore take longer to change their methods.

Buabeng-Andoh (2012) concurs that ICT is becoming progressively more significant in our lives and schools. There is increasing pressure on schools to use ICT to teach the skills and expertise needed for the 21st century. For teachers to be able to teach the skills needed, they need to have the necessary ICT competency. ICT competency is outlined as "being able to handle a wide range of computer software for various purposes" (Buabeng-Andoh, 2012, p. 139).

There are several aspects that will affect whether teachers use ICT. Teacher attitudes knowledge and opinions impact whether they use ICT or not. Research has demonstrated that how teachers feel about technology will affect their approval of the effectiveness of technology and its combination with instruction (Huang & Liaw, 2005). If the attitudes of teachers are confirmed towards the use of technology, even for planning and administration, then they will easily see the usefulness about adopting and integrating ICT into teaching and learning. Teachers should be positive about the use of ICT in teaching to be able to use ICT to teach 21st century skills. Teachers need to perceive technology to be better than the traditional lecture method. Technology should be easy to use so that teachers can experiment before adopting ICT into their teaching. Once ICT tools are adopted into teaching and learning, innovation from teachers will be visible to students and student may follow the example (Buabeng-Andoh, 2012). Evidence proposes that teachers who had a negative mindset about integrating ICT into teaching, required knowledge and skills that would let them make "informed decisions" about the use of ICT (Buabeng-Andoh, 2012).

Several teachers are hesitant to use ICT, even simple tools like computers and the internet. Reasons for this hesitation are weak software design, doubt about the effective use of technology in successful learning, lack of assistance, lack of time to feel comfortable with the technology and the ways to adopt it for teaching, and fear of losing control in the classroom because teaching is now more learner-centred (Buabeng-Andoh, 2012). Meenakshi (2013) believes that ICT can empower teachers

and make substantial contributions to performance and achievement. Introducing ICT effectively will be particularly advantageous to students' learning and performance.

Having access to educational resources is crucial to prepare students to play "full roles in modern society and to contribute to a knowledge nation" (Department of Basic Education, 2004, p. 14). However, having access to facilities only does not secure the automatic acquisition of 21st century skills. School systems have for some time, been investing in the use of ICT to enhance education and not to teach 21st century skills. Chenglie (2017) asks if they have invested efficiently to guarantee that teachers are at the forefront of the design and application of ICT-integrated pedagogical techniques in classrooms. The educational effectiveness of ICT changes how it is used and what it is used for. And like other tools for educational delivery, ICT tools do not work in the same way for all. It is not easy to measure the extent to which ICT tools have helped access to education.

Technologies should be used in collaboration with conventional methods rather than as the only delivery method. ICT should be made available to students for both work and play. This would achieve two aspects of ICT (Amin, 2013):

1. Teaching to use the ICT itself, and
2. Including ICT as an instrument to improve the current teaching strategies.

As mentioned earlier, teaching the use of ICT itself is important. ICT application should be accessible to teach computer literacy. Students need to be taught to use the ICT tools as well as acquiring the 21st century skills for them to be global citizens. Teaching software skills and using ICT in class for teaching will enhance learning. Engaging with technology without obtaining 21st century skills may not lead to improved performance. The possibilities of using ICT to enhance educational methods and results are often guessed at and not obtained scientifically (U.S. Department of Education, 2017).

Encouraging a joint effort in pursuing successful ICT integration in learning may ensure its sustainability. The study Scholkmann (2017) performed in Germany showed that students gained competence by actively participating in designed activities. ICT has revolutionised how knowledge is offered, delivered, and acknowledged by both teachers and students. However, the problem with ICT integration in learning is the ways technologies are used to enable understanding, retaining, and application of knowledge. To overcome the challenge, collective determination to integrate ICT in

education is needed that moves into deep-rooted learning to connect students with knowledge achievement and application through "critical and analytical thinking, thus achieving a higher level of learning outcomes" (Chenglie, 2017, p. 2668).

Teachers were taught to use a suitable pedagogy to explain the content. Efficient ICT integration into teaching brings new challenges and requires teachers to gain new understanding to effectively use ICT and evaluate the influence of the use of ICT on results. Successful use of ICT to enhance 21st century skills teaching in education needs preparation, investing, and professional training for teachers (Ghavifekr & Rosdy, 2015). For ICT to improve results, systematic planning and experimentation are needed. Teachers should identify difficult areas for students and then students can practise finding solutions with the use of ICT.

We need to look at patterns and connections that can be made to complement traditional teaching with technology. Tirocchi and Taddeo (2013, p. 12) summarises the effective use of ICT as follows:

1. "Investments in technology must play a supplementary role compared to the investments in human and social capital. The mere presence of technology is not the issue that significantly affects the impact and sustainability of technology-based innovation."
2. Teachers become "hubs", that can "push and disseminate the innovation."
3. "Digital literacy must be spread among teachers, promoting the acquisition of digital skills", trying to bridge the digital divide through training.
4. Teachers should be encouraged to play a key function in the system. Participants, parents and educational institutions are important factors in the journey towards innovation.

Teachers, and not only technology, represent the most important resource. Teachers are central to effective ICT integration by delivering innovation using ICT in the classroom. ICT brings new ways that subjects are delivered, changes the places where learning occurs, and updates pedagogies to improve student results. Students can use ICT to obtain information in various ways for lifelong learning or exploration (Amin, 2013).

CSR Asia (2017) explored how ICT can enable the accomplishment of the United Nations (UN) Sustainable Development Goal Four (SDG4). ICT in education can help

simplify education processes and enhance the quality of education. There is a need for collective action, where key players actively participate in helping to shape the future of education. Education managers must take sufficient action to establish the best application of resources to ensure that ICT enables positive learning outcomes in education. A cooperative approach will inspire the ICT industry to employ best practices and participate responsibly in education programmes, including the advancement of sustainable development matters and strengthening the education sector's ability to provide wide-ranging and fair quality learning opportunities for all (CSR, 2017).

Speedy developments in the ICT field are changing the way we interact individually, locally and internationally and what we see as our responsibility. ICT is not only changing the "way we communicate, collaborate and work – it is also changing how and what we learn." ICT changes many parts of daily life as it is reforming education and creates an outstanding possibility to achieve a striving universal education agenda (CSR, 2017, p. 11).

2.7 SOUTH AFRICAN EDUCATION SYSTEM AND 21ST CENTURY SKILLS

OBE (Outcomes Based Education) was launched in 1997 and was also known as Curriculum 2005 (Department of Education (DoE), 1997). This curriculum aroused different reactions. Some believed that this was an attempt from government to equalise an unequal education system by providing equal opportunities to students from different backgrounds, races, economic status and disabilities. This would provide better curriculum focus, better curriculum delivery and reliable assessments (Lombard, 2010).

OBE was revised in 2004 and the Revised National Curriculum Statement (RNCS) for the General Education and Training Band and the National Curriculum Statements for the Further Education and Training Band were introduced (Department of Basic Education, 2003). The first cohort of Grade 12s wrote the first NCS examination in 2008. Bodies such as Umalusi carefully analysed the results obtained in this examination to determine if students had met standards against those of previous years. Nel and Kistner (2009) stated that students were not ready for tertiary studies based on their first results.

South Africa is still developing but the Department of Basic Education aims to create a South African education system embracing the 21st century and promises that all citizens will be provided with lifelong learning opportunities which should contribute towards "improving quality of life and building a peaceful, prosperous and democratic South Africa" (Department of Basic Education, 2015). The aim is to provide a system where students are taught to critically think about global problems, and assessment practices are moving to the assessment of lower level thinking as well as higher level thinking (Department of Basic Education, 2003).

The Critical Outcomes integrated into South African school subjects according to The National Curriculum Statement (2003, p. 2) require students to be able to:

- "Identify and solve problems and make decisions using critical and creative thinking;"
- "Work effectively with others as members of a team, group, organisation and community;"
- "Organise and manage themselves and their activities responsibly and effectively;"
- "Collect, analyse, organise and critically evaluate information;"
- "Communicate effectively using visual, symbolic and/or language skills in various modes;"
- "Use science and technology effectively and critically showing responsibility towards the environment and the health of others;" and
- "Demonstrate an understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation."

These Critical Outcomes are underpinned by 21st century skills. Integration is aimed to be combined across subjects and learning fields. The combination of knowledge and skills between subjects is vital in performance and achievement. In implementing the acquired integration and needed skills, the National Curriculum Statement Grades 10 – 12 (2003) seeks to advance a combined learning of "theory, practice and reflection." The White Paper (Department of Basic Education, 2004) states that when ICT tools are successfully combined into teaching and also into learning, high order critical thinking skills such as understanding, logical thinking, problem-solving and innovative thinking can be enhanced.

The South African Education Department aims to develop the necessary skills through the integration of ICT, and the Action Plan 2019: "Towards the Realisation of Schooling 2030" (Department of Basic Education, 2015) states that strategic changes should be made to achieve learning improvement goals. To date, this is not shown in the academic results of students. Mouton, Louw & Strydon (2012) state that TIMSS ("Trends in Mathematics and Science Study"), PIRLS ("Progress in International Reading and Literacy Study"), and SACMEQ ("Southern and Eastern Africa Consortium for Monitory Educational Quality") show that South African students perform well below their academic potential. Mouton, Louw & Strydon (2012) also claim that the education system in South Africa does not provide excellence, but continues to provide mediocre results every year. This cannot be continued and needs to be changed structurally and systemically (Vandeyar, 2015), not only through policy. Many schools are not embracing the opportunities of the 21st century and this can only be changed through careful consideration by policymakers. The traditional culture of teaching and learning is still mostly followed and this is characterised by a lack of teaching of 21st century skills.

2.8 STEM EDUCATION

STEM (Science, Technology, Engineering and Mathematics) education is a movement to link science, technology, engineering and mathematics (National Governers' Association, 2007). Mobley (2015, p. 25) defines STEM education as "an educational approach in which interdisciplinary applications are made to solve problems in real life and links to different disciplines are created." STEM attempts to teach science, technology, mathematics and engineering as one field. The aim is to enhance students' 21st century skills, innovation, creativity, critical thinking and problem-solving. STEM is directly related to the Sustainable Development Goals (United Nations Development Programme (UNDP), 2016).

Education departments reform education to focus on STEM fields. Science improves understanding of the physical world, and at the same time develops experimentation skills and collaboration. Skills like creativity, subjectivity, global and local connections are developed. Technology provides the interface between science and humans and the ability to analyse statistical findings creatively. Engineering includes problem-solving of real-word problems using science and scientific products. Mathematical

skills include interpretation and analysis of information, problem-solving, decision making, and deeper understanding of problems (McDonald, 2016). All these skills are taught through STEM education and correlate with the 21st century skills needed in a global world. STEM education helps to teach 21st century skills (Stehle & Peters-Burton, 2019)

2.9 SUMMARY OF CHAPTER

Table 2.1 displays a summary of the literature studied in this chapter.

Table 2.1: Summary of Literature Sources

Topic	Findings	Reference
ICT4D	The ICT4D (ICT for development) approach theorises that ICT can be used as a tool for development and teaching and learning.	(Heeks & Wall, 2018)
ICT affordances	Education systems regard the perception of ICT and the essential skills and values of ICT as part of the essence of education. The use of ICT in the education process has been divided into ICT for Education and ICT in Education.	(Amin, 2013)
	How to use technology correctly is not defined in detail yet, and the use of technology is based on acceptance rather than pedagogical theory	(Conole & Dyke, 2004)
	South African education managers focus on using ICT to accelerate the attainment of national education goals. The aim is to connect students and teachers and to provide professional training facilities and to offer programmes for learning.	(Department of Basic Education, 2004)
	ICT helps support and development relationships between students and teachers, adjusts learning styles for cooperation, shrinks the digital divide, and adjusts learning practices to meet the requirements of all students.	(U.S. Department of Education, 2017)
21st century skills	The aim should be to develop globally competitive and involved citizens. Schools should combine 21st century skills, including critical thinking, problem-solving, collaboration and communication skills, into the teaching of all subjects.	(U.S. Department of Education, 2017)
	The four Cs ("critical thinking, communication, collaboration, and creativity") should be built into education. The Four Cs need to be integrated into classrooms and schools to prepare students of today to become global citizens.	(National Education Association, 2012)
	Changes in economies demand shifts in education and subsequently teaching and learning. Shifts in education systems would force	(Care, Griffin, & Wilson, 2018)

	curricula to change. Curricula should encompass lifelong learning approaches to education.	
	Sustainable Development Goal 4 calls for skills beyond reading ability and mathematical ability – including skills needed to encourage global social conscience and sustainable development. The global conversation moved to an alarm about social conscience and worldwide capability. This is underpinned by the teaching of 21st century skills.	(United Nations Development Programme (UNDP), 2016)
	The Assessment and Teaching of 21st Century Skills (ATC21S) initiative was created by commercial organisations because of concerns that future workforces required 21st century skills in workplaces.	(Griffin, McGaw, & Care, 2012)
	Binkley et al. warn us that without a certain intensity of detail in preparation, the announcements of the 21st century aims and objectives will not be shown in the learning experiences of students. They suggest that curricula should be designed and re-designed to reflect successful teaching and learning of 21st century skills. The KSAVE model provides teachers and schools with a "more specific set of goals of what students should demonstrate when they learn a particular skill."	(Binkley, Erstad, Herman, Raizen, & Ripley, 2009)
	Suggestions for effective implementation of teaching of 21st century skills into curriculum.	(Voogt & Roblin, 2012)
	Nieveen and Plomp propose five driving values for the process of change.	(Nieveen & Plomp, 2017)
	The use of ICT in the classroom does not ensure learning. The focus has been on providing schools with ICT without trying to develop the necessary skills surrounding the use of ICT.	(Pineida, 2011) (Anderson, 2008)
	There is a chance to discover new possibilities to develop higher order thinking skills, cognitive ability and positivity towards continuous learning.	(Department of Communications & Digital Technologies, 2020)
	Students need to take part in global challenges, such as climate change and poverty, to be more informed and engaged citizens.	(Bourn, 2018)
	The pedagogy for the 21st century needs to be rethought.	(Scott, 2015)
	Students must improve their own skills and enhance their own learning to be able to address global challenges	(Leadbeater & Wong, 2010)
Design Thinking	Education should pay attention to design and insert design thinking as a crucial part of education. Nurturing design thinking is vital in the information age and driven by technology.	(Koh, Chai, Wong, & Hong, 2015)
	Creative thinking is not only concerned about content but about procedure. Thinking processes	(Allegra, Chifari, & Ottaviano, 2001)

	involved in each subject must be enhanced didactically to develop creative thinking.	
Effectiveness of ICT integration	Not all schools have ICT available for teaching and many teachers are still using traditional methods.	(Hepp, Hinostroza, Laval, & Rehbein, 2004)
	Teachers' opinions on whether ICT will be effective for teaching and learning in the classroom are important and this will influence successful implementation.	(Adom, Yeboah, & Ankrah, 2016) (Ghavifekr & Rosdy, 2015)
	Teachers need to have the necessary ICT competence to teach the skills needed.	(Buabeng-Andoh, 2012)
	Teachers' perceptions about technology influences the reception of technology and its usefulness into teaching.	(Huang & Liaw, 2005)
	ICT can support teachers and make important changes to learning and performance. Introducing ICT adequately will be particularly effective in student's learning and achievement.	(Meenakshi, 2013)
	Have school systems devoted enough effort to ensure that teachers are effectively implementing ICT-integrated educational systems in their classrooms?	(Chenglie, 2017)
	CSR Asia (2017) explored how ICT can enable the attainment of the United Nations (UN) Sustainable Development Goal 4 (SDG4).	(CSR, 2017)
South African education system and 21st century skills	The South African government and Education Department aims to develop the necessary skills through the integration of ICT, and the "Action Plan 2019: Towards the Realisation of Schooling 2030" states that strategic changes should be made to achieve learning improvement goals.	(Department of Basic Education, 2015) (Department of Basic Education, 2004) (Department of Telecommunications and Postal Services, 2016)
STEM Education	STEM education is "an educational approach in which interdisciplinary applications are made to solve problems in real life and links to different disciplines are created."	(Mobley, 2015)

2.10 CONCLUSION

The use of ICT in education offers many affordances, including new online learning tools, easier access to information, development of 21st century skills, support in teaching and learning, motivation of students and teachers, improved performance, fostering co-operative learning and many more benefits. However, there is evidence that technology is not easily accepted by many and thus there is slow uptake in using technology in the classroom.

Even though evidence suggests that ICT tools are integrated in teaching and learning and offer the opportunity to develop 21st century skills, the success is still questionable. Education managers should ensure that ICT tools are effectively integrated to prepare students for global challenges. Literature proves that ICT tools are used in schools and classrooms, for reasons like planning, demonstration, etcetera; however, it is not clear how ICT tools are used to teach 21st century skills.

CHAPTER 3 – RESEARCH DESIGN

3.1 INTRODUCTION

Chapter 2 described the literature studied on the usage and affordances of ICT, 21st century skills and the thinking behind the successful integration of ICT to teach 21st century skills.

Chapter 3 discusses the details of the research design and methodology chosen to conduct this study and includes the research paradigm, research approach, sampling and procedures, data collection tools, data analysis methods and ethical considerations.

Social research is defined by DePoy and Gitlin (2016) as strategies to determine knowledge about how humans behave, their experiences and environments. A research design offers a structure of how data can be collected and analysed. The decision of which research design to follow will influence the overall approach that will be used to combine various parts of the study in a clear and plausible way. The aim of the research design addresses the research problem (Saunders, Lewis, & Thornhill, 2012).

The approach used in this chapter is adapted from Saunders' Research Onion (Saunders, Lewis, & Thornhill, 2012). Saunders' Research Onion moves from the outside layer towards the inside layer. Each layer clearly describes the stage of the research process (Saunders, Lewis, & Thornhill, 2012).

Figure 3.1 below depicts the Research Onion.

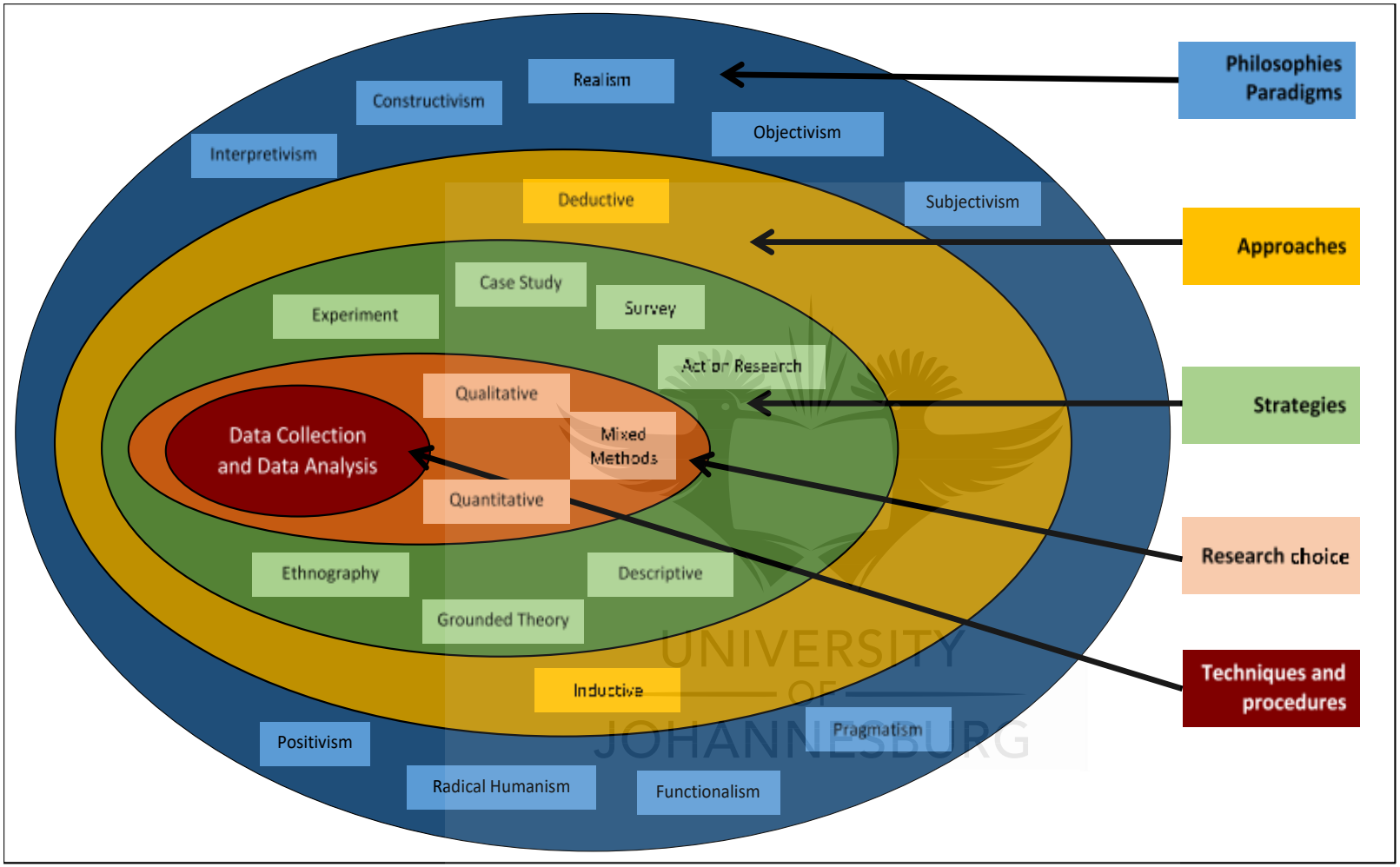

Figure 3.1: Saunders Research Onion (adapted from Saunders et. al., 2012)

Figure 3.2 below depicts the chapter outline.

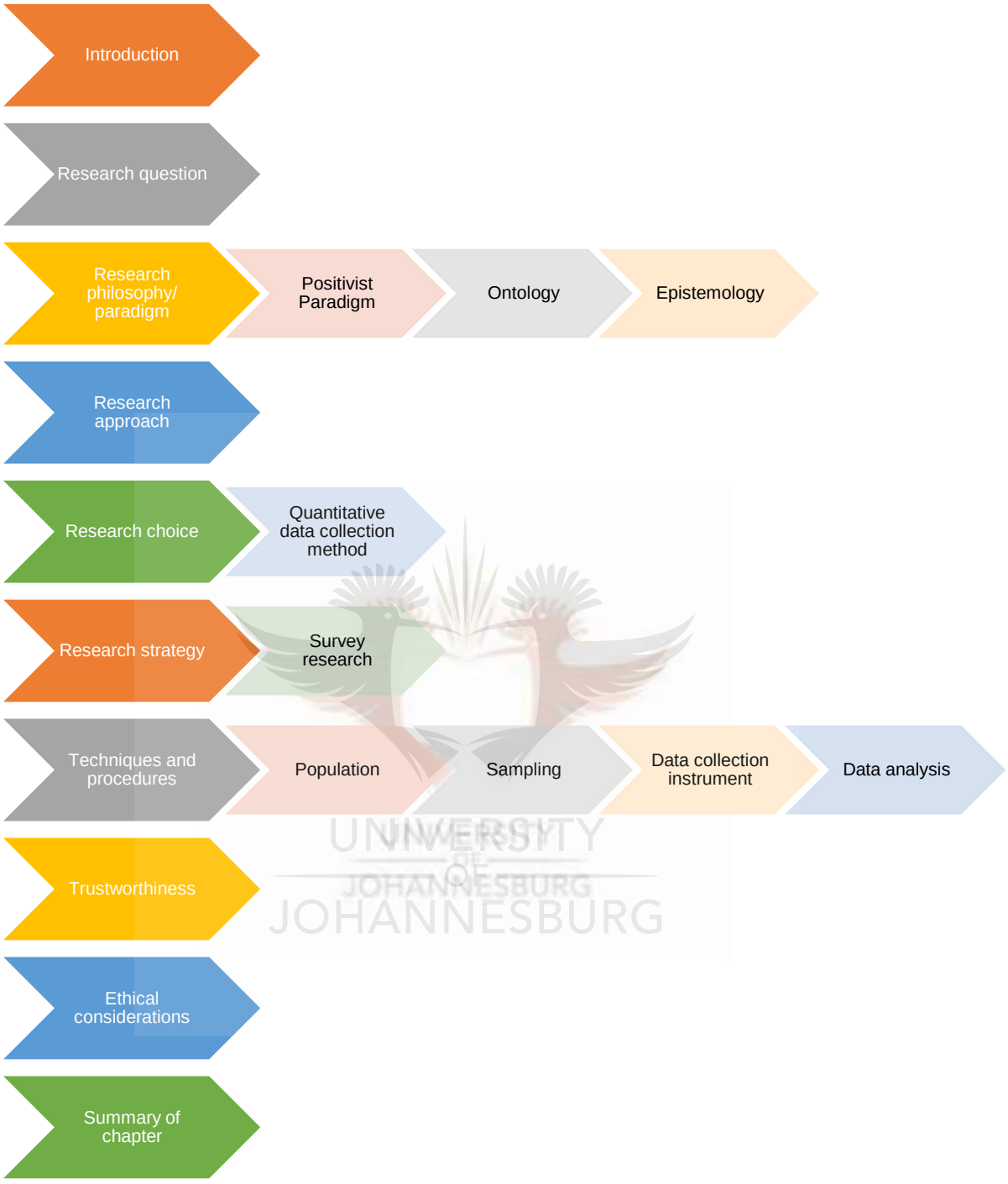

Figure 3.2: Outline of Chapter 3

3.2 RESEARCH QUESTION

The chapter synthesises the research design and methodology to be able to answer the research question: *To what extent do teachers integrate ICT to enhance 21st century skills in schools?*

Research methodology is defined as the methods the researcher uses to conduct his or her study. The research methodology stipulates how the researcher plans on gathering information to provide evidence that will either support, refute, or conclude the research question during the study (Cresswell, 2014). The next sections will explain what research methodology was used to conduct this study.

3.3 RESEARCH PHILOSOPHY/PARADIGM

In research, specific viewpoints determine what knowledge is and how knowledge is obtained. This is called a research philosophy or a paradigm (Bryman, 2012). There are many paradigms that exist, mainly because the way humans think has changed and the different ways reality and the implications thereof is explained (Adom, Yeboah, & Ankrah, 2016). The standpoint of this study is that reality is dependent on the experience of its participants. Scotland (2012) divides a paradigm into the following components: ontology, epistemology, methodology, and methods.

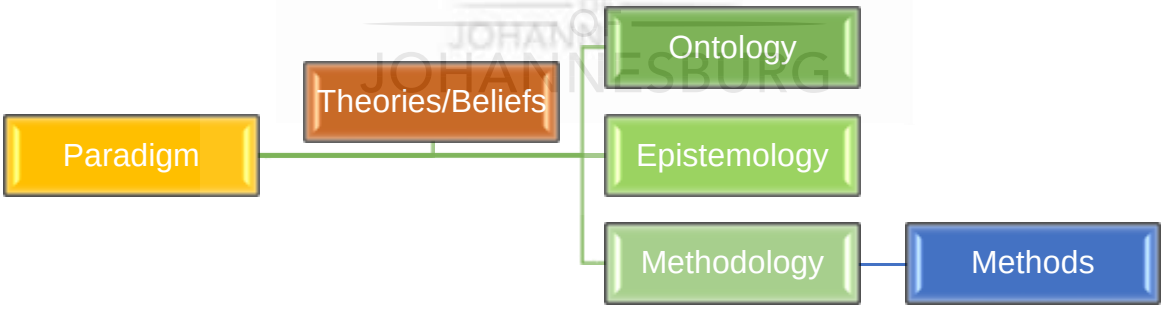

Figure 3.3: Components of a Paradigm

Bryman (2012) defines a research philosophy or paradigm as a set of beliefs regarding the nature of what is investigated. Rehman and Alharthi (2016) states that a paradigm is seen as a simple perspective, mindset and a theoretical framework with certain beliefs. Each study follows a specific paradigm when conducting research based on a theoretical framework. A paradigm therefore is a pattern of how something is

structured and how one's view of reality is constructed (Huitt, 2011). A paradigm consists of ontological, epistemological and methodological aspects.

- Scotland (2012) explains that **ontology** investigates what reality is. A researcher's position is centred at perceptions of how things really work.
- **Epistemology** researches how knowledge can be formed, obtained and transferred (Scotland, 2012).
- **Methodology** is the plan of how the research will be conducted (Scotland, 2012).

3.3.1 Positivist Paradigm

Positivism describes an approach that is dependent on empirical evidence in the form of data and experiments, to show a true reflection of how society is seen to operate (Scotland, 2012). Positivism is a philosophy that has the view that only "factual" knowledge obtained from observation and quantifying this observation can be trusted. In positivist research the responsibility of the researcher is to collect the data and interpret it in an unbiased way. The researcher and participants researched are independent from each other (Scotland, 2012).

Positivist observations are quantifiable which leads to statistical analysis. This study used the positivist paradigm to gather statistical data that was not be influenced by the views of the researcher. Positivism reports relationships between different components of the world (Kara, 2018) and believes that knowledge stems from the observation of human experience which this study aims to collect through research.

According to Bryman (2012), positivism involves the following:

- Only knowledge observed by the senses can be trusted as knowledge;
- Knowledge is obtained through data gathered; and
- Research conducted must be objective.

Data gathered for this study was not influenced by the view of the researcher, thus objective. A questionnaire was used as a measuring instrument. The questionnaire gathered data about the views of teachers and aimed to not allow for different ways in which the ideas, presented in the instrument, could be understood by the participants.

To keep the study objective and in line with the positivist approach, several definitions were provided for 21st century skills and teachers were asked to choose the definition of a particular 21st century skill they most agree with in the questionnaire. This ensured

that participants did not simply choose the answer they expected the researcher desires. After a pilot study was conducted it was found that participants may not be honest about their teaching and a definition was provided for each 21st century skill to determine if teachers understood the 21st century skill.

3.3.2 Ontology

Ontology is the study of reality (Richards, 2003). It revolves around the study of all that exists, the different perceptions within reality and what impact it has on the social world. It differentiates between reality and how reality is perceived. Goddard and Melville (2004) observed that a person needs to know what reality truly is, the result of this reality on the world and the individuals that live in the world. Ontology studies how reality influences the behaviour of the people.

The ontological position of positivism is centred around the belief that a single observable reality exists, and this reality can be recognised, acknowledged, and quantified (Park, Konge, & Artino, 2020). Positivism takes on the ontological understanding of the world and the world is seen as elements and occurrences that can be observed and the interaction between them can also be observed (Collins, 2010). The ontological view of positivism is also realism, understanding that the world has a cause-effect relationship (Rehman & Alharthi, 2016). This study gathered data through empirical research about how teachers integrate 21st century skills in their teaching, how teachers perceive 21st century skills and how they deal with external challenges, will influence the integration thereof. Reality will be determined by teachers' perceptions of their integration of 21st century skills.

The reality of this study is seen as the school situation of the participant and whether ICT integration is taking place in teaching 21st century skills. This is influenced by the support provided by the school and the general attitude of the school management towards ICT integration and if 21st century skills are taught. The perception of the teacher and whether he/she sees himself/herself integrating 21st century skills with the use of ICT in the classroom is the reality that is being observed.

3.3.3 Epistemology

Epistemology studies the forms of knowledge, is concerned with how knowledge can be obtained and how this knowledge can be transferred to others (Cohen, Manion, &

Morrison, 2007). The epistemological stance of positivism is objectivity (Rehman & Alharthi, 2016). Researchers enter only as unbiased onlookers to study facts and experiences that exist independent of the researchers and the researchers may not change or disrupt what they are observing (Scotland, 2012).

Positivists argue that knowledge must be obtained unbiased, without the participants or researchers influencing the views obtained, or altering the development of knowledge. Knowledge, when appropriately obtained, is absolute truth and becomes certain, accurate and consistent with reality. To appropriately obtain truth, participants and researchers may not meet. To accomplish this, positivists work in isolation and objectivity (Park, Konge, & Artino, 2020).

Positivist epistemology believes that reality should be observed independently from the researcher. This study gathered data using an online questionnaire, the researcher had no contact with the participants, data was quantified and thus, knowledge about the studied reality was obtained.

3.4 RESEARCH APPROACH

Corresponding with Babbie's (2010) view, a research approach recognises the basis of the research strategy and directs the research methods. Two approaches are identified: deductive and inductive. The deductive approach entails the development of a theoretical framework which will be assessed empirically (Collis & Hussey, 2013). This approach gathers data quantitatively, analyses the data and draws conclusions from the data. Generalised conclusions can be reached (Collis & Hussey, 2013).

This research aims to use the deductive approach whereby data is gathered through a specific instrument. The research question "To what extent do teachers integrate ICT to enhance 21st century skills in schools?" has the premise that teachers do in fact integrate ICT and teach 21st century skills. This research presumes that teachers are by now integrating ICT tools in their classrooms and supposes that teachers are teaching 21st century skills. Thus, this study aims to determine if teachers perceive themselves as integrating ICT tools, how often they integrate ICT tools and teach 21st century skills in their classrooms.

3.5 A QUANTITATIVE RESEARCH CHOICE

This layer of the Research Onion (Saunders, Lewis, & Thornhill, 2012) helps to decide whether quantitative, qualitative or a mixed method dataset should be used. According to Saunders et al. (2012), there are three research methods to select from: mono method, either quantitative or qualitative; mixed, a combination of quantitative and qualitative; multi-method, certain sections of a study use quantitative and other sections qualitative. Researchers may choose between qualitative, quantitative or mixed methods.

Bryman (2012, p. 35) defines quantitative research as "A research strategy that emphasises quantification in the collection and analysis of data…."

This study uses quantitative data to quantify the research problem and transform the data into statistics. Quantitative data provides numbers to establish whether teachers are capable of identifying 21st century skills and if they include these skills in their teaching practices. Measurement requires a systematic procedure to assign scores to individuals' responses. The items in the data collection instrument (questionnaire) are ordered, ranging from agreeing the least to agreeing the most. Scores were added to the responses using numerical scales in which intervals have the same interpretation throughout (Chiang, Jhangiani, & Price, 2015).

Positivist research is based on quantifiable statistics. Gall, Gall & Borg (2003, pp. 19-20) explain it as follows:

> "The use of quantification to represent and analyse features of social reality is consistent with positivist epistemology. Because this epistemology assumes that features of social reality have a constancy across time and settings, a particular feature can be isolated and it can be conceptualised as a variable, that is, as an entity that can take on different values. These values can be expressed as numerical scales."

The data which quantitative researchers using the positivist approach use to answer their research questions, is usually collected through a variety of surveys, making use of closed ended questionnaires (Gall, Gall, & Borg, 2003). Results for this study were collected through a survey using an online questionnaire.

Rehman (2016) and Almeida, Faria and Queiros (2017), state the following advantages of quantitative datasets:

- The research can involve a larger sample, which in turn makes the data more trustworthy.
- Development times of surveys are low.
- No interference by the researcher. Data becomes objective because there is no direct contact between the researcher and the participant.
- Data analysis is faster since it uses software such as SPSS.

The disadvantages of quantitative research are (Rehman & Alharthi, 2016; Almeida, Faria, & Queiros, 2017):

- Deeper meanings and explanations are not obtained.
- Measurement is only taking place at a specific moment and is not continuous.
- Reliability of the data depends on the value of the answers.
- Behaviour and emotions are not captured.

Quantitative research is used more often to study opinions and the findings in turn are used to make generalised assumptions for a greater population. Development of the survey and analysis of results are not too time consuming and since the researcher has very little contact with the participants, quantitative research could be seen to be more favourable. To overcome the disadvantage of low-quality data, the questions were carefully considered to be able to capture respondents' opinions accurately. Definitions were provided for each 21st century skill to ensure participants have a common understanding. An existing questionnaire was used in this study and an additional question was added to each section to be able to identify contradictions, or whether participants were choosing the answer they expected the researcher would prefer. This type of study can be replicated to test the outcome of the results.

3.6 RESEARCH STRATEGY: SURVEY RESEARCH

A research method or strategy is a method for data collection (Horne, 2018). It can use a specific tool, such as an online or offline questionnaire or an interview, or observation process where the researcher only observes others (Bryman, 2012) . For this study, the survey research strategy is used.

The survey research level of the research onion is often one of the most economical research strategies (Saunders, Lewis, & Thornhill, 2012). The study uses a quantitative descriptive survey. Researching with a survey collects data about participants through questionnaires or interviews, including their preferences, feelings, and behaviours (Bhattacherjee, 2012). Most survey research is non-experimental. It is used to describe single variables and also to establish statistical relationships between variables (Price, Jhangiani, & Chiang, 2015).

Researching with surveys is divided in two categories: questionnaire surveys and interview surveys (Bhattacherjee, 2012). For this study, a standardised questionnaire was used to conduct the survey. Survey research has several advantages according to Bhattacheriee (2012) and Almeida, Faria & Queiros (2017):

- Surveys are outstanding instruments for measuring people's perceptions, behaviours, traits, beliefs and attitudes.
- Surveys are used for gathering data about a large group of people who cannot be observed individually.
- Surveys are preferred because of their convenience and subtleness.
- The use of surveys is less time-consuming, cheaper and requires less effort.

Survey research does, however, have several disadvantages as stated by Saunders, Lewis & Thornhill (2012) and Almeida, Faria & Queiros (2017):

- No assistance is provided when participants are answering the questions.
- Open-ended questions are difficult to ask.
- It may happen that the right participant did not answer the questions.
- No additional data can be collected.
- They have lower response rates than interviews.
- There is a greater risk of missing data.

This study attempted to collect data about teachers' perceptions and opinions about them teaching 21st century skills in their classrooms. A survey proved to be a convenient tool since it measures perceptions and observing a large number of teachers would have been impossible and too time consuming for this study. When planning the data collection instrument, the necessary data that should be collected should be carefully considered. The online survey system used in this study contains certain validity tools, such as making questions compulsory, to limit missing data and

increase response rates. Questions were explained so that participants had a common understanding of concepts used. Perceptions and opinions were collected. Due to COVID-19 lockdown restrictions, an online survey proved to be beneficial since schools did not allow visitors.

3.7 TECHNIQUES AND PROCEDURES

The final layer of the Research Onion (Saunders, Lewis, & Thornhill, 2012) mentions techniques and procedures. This refers to the population and sample selected to collect data and then analyse it.

To answer the research question, the researcher is not able to collect data from large numbers of participants, therefore a sample needs to be selected. All the cases a researcher can draw from is called the population (Taherdoost, 2016).

Taherdoost (2016) identifies the following stages when conducting sampling:

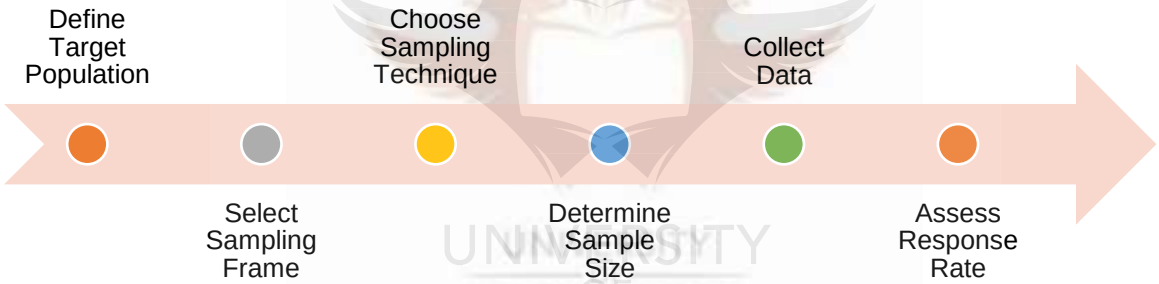

Figure 3.4: Stages of sampling

Stage 1 Define Target Population: Population is the total number of cases from which respondents can be selected.

Stage 2 Select a Sampling Frame: A list of the actual cases from which selections can be made.

Stage 3 Sampling Technique: A subset from the sample can be selected. The techniques that can be used for sampling are called probability sampling and non-probability sampling.

- *Probability sampling* proposes that every case has an equal probability of being selected (Bryman, 2012). Examples include stratified random, simple random, systematic, cluster and multi-stage sampling (Taherdoost, 2016).

- *Non-probability sampling* focuses on a smaller sample with a clear rationale of inclusion. Examples include quota, judgement, convenience and snowball sampling (Taherdoost, 2016).

Stage 4 Determine the Sample Size: The sample size is important since this will influence the findings of the researcher. Sizes of less than 30 will produce skewed results. Larger sample sizes will provide more reliable results (Flick, 2011). From the schools selected it was planned that one hundred participants would be approached. The size was increased from the original study in West Virginia to improve quality.

Stage 5 Collect Data: As soon as the population, sampling frame, sampling techniques and sizes have been determined, data can be collected.

Stage 6 Assess the Rate of Response: The response rate includes the total number of cases that agreed to participate in this study. The aim is to achieve a 100 percent response rate, but this does not often happen.

3.7.1 Population

Quantitative studies require large numbers of participants (Williams, 2007). A population is defined by Bryman (2012) as the variety of parts out of which the sample will be selected. Sample is defined as the "segment of the population that is selected for investigation. It is a subdivision of the population" (Bryman, 2012, p. 187). The population of this study includes all secondary schools in Gauteng province.

The purpose of this research is to establish if teachers are incorporating 21st century skills such as innovation, collaboration, communication and problem-solving into their teaching. A group of one hundred teachers selected from a range of secondary schools in Gauteng province in South Africa were requested to take part in the survey research by completing a questionnaire. No identification or exposure was necessary. The questionnaire was posted online, and no contact took place between the researcher and the participants. Therefore, the participants were not exposed to any identification by the researcher. Participation was voluntary, and no participant names or school names were published. The fact that teachers and whether they teach the necessary skills, were not identified, makes the study low risk.

3.7.2 Sampling

Sampling is applied to decrease the number of cases (Taherdoost, 2016). It is unfeasible to use a sample which is the size of all the schools in the province, therefore a non-probability sample selection was used.

Samples in quantitative research are based on selection criteria which check if members of the whole population meet these. If the criteria are satisfied, a person is included (Williams, 2007).

The sampling method selected is convenience sampling. Participants are included based on non-random criteria (Bhattacherjee, 2012). Taherdoost (2016) states that convenience sampling is a strategy where persons or situations are consciously selected. The researcher chooses situations or participants and includes them in the sample as they are easily accessible to the researcher (Maxwell, 1996). Convenience sampling is applicable to both qualitative and quantitative studies but is mostly used in quantitative research (Etikan, Musa, & Alkassim, 2016). Etikan, Musa & Alkassim (2016) also state that the aim of quantitative studies is breadth of understanding while qualitative studies aim for depth of understanding. Convenience sampling involves including participants based on the fact that they are easily available (Taherdoost, 2016). Convenience sampling is chosen for this study since it is inexpensive and easy (Bryman, 2012). Convenience sampling overcomes several limitations associated with research (Taherdoost, 2016). Limitations include access to participants, cost, travelling in lockdown during COVID-19 conditions.

The sampling frame includes schools that offer Computer Applications Technology and Information Technology since these schools would be easily accessible to the researcher. All schools from the relevant districts that offer the abovementioned subjects were selected. Snowball sampling was then followed where the respondents were identified, and then asked to recommend Mathematics and Mathematical Literacy educators from their schools to participate (Bhattacherjee, 2012).

The responses were limited to the three selected districts in Gauteng: Gauteng West (D2), Sedibeng West (D8) and Ekurhuleni South (D16) as it would have been more demanding to gather and analyse data from 15 districts. Schools selected were from regions towards the south of Gauteng. These districts were also selected based on convenience sampling as the location and teachers were more accessible to the

researcher. The COVID-19 conditions were considered, as schools would not allow visitors amidst a nationally declared pandemic.

The following criteria were developed for the easy selection of the schools:

- The school is located in Gauteng West, Sedibeng West or Ekurhuleni South;
- The school is a secondary school;
- The school offers CAT and/or IT, Mathematics and/or Mathematical Literacy;
- The school is public or private.

Results will be presented using different criteria, so as to compare the outcomes of the different categories.

A survey is used to understand a specific observation and then it allows researchers to compare understandings of concepts of participants. This is done through empirical research. The data that is gathered helps to analyse the observations (Saunders, Lewis, & Thornhill, 2012).

3.7.3 Data collection instrument

The numbers of online surveys are significantly growing. Online surveys can be administered by email or via the web (Bryman, 2012). Web surveys have one benefit over email surveys since questionnaire appearances can be changed (colour, styles, formatting). Web surveys may use online questionnaires as a data collection instrument. Respondents indicated that they feel more comfortable completing online questionnaires because they spend many hours online and it is not necessary to submit the questionnaire by hand.

During the current lockdown restrictions, an electronic survey system, namely Google Forms is more suitable to distribute the questionnaire and collect data efficiently.

The data collection instrument is a questionnaire[1] (see Addendum H – Questionnaire) designed by the West Virginia Department of Education to determine whether teachers are perceiving themselves as integrating 21st century skills into their classes (Hixson, Ravitz, & Whisman, 2012). The conceptualisation of the skills (specifically 21st century skills) was taken from the "International Innovative Teaching and Learning Study" (Shear, Novais, Means, Gallagher, & Langworthy, 2010). The context in the

[1] Permission was obtained from the author Jason Ravitz on 28 February 2020.

questionnaire was carefully considered when reviewing the literature and included the following key concepts (Shear, Novais, Means, Gallagher, & Langworthy, 2010, p. 59):

- "Knowledge Building: Students move beyond the reproduction of information to construct knowledge that is new to them.
- Problem-Solving and Innovation: Students solve problems for which there is no previously learned solution, make choices in their approach, and implement their solutions in the real world.
- Skilled Communication: Students present their ideas in ways that are clear and compelling, and present sufficient relevant evidence on a topic or theme.
- Collaboration: Students work together in groups, take on roles, and produce a joint work product.
- Self-Regulation: Students plan and monitor their work and make revisions based on feedback or self-assessment.
- Use of ICT for Learning: Students use ICT to construct knowledge; choose when, where, and how to use it; and evaluate the credibility and relevance of online resources."

The questionnaire determines if teaching of critical thinking, collaboration, creativity and innovation, communication, self-direction skills, is taking place in class according to the views of the participants. The skills measured in this instrument are the same as the 21st century skills mentioned in this research.

The West Virginia survey was conducted "amongst teachers who were trained in PBL (Project Based Learning) at TLI by Buck Institute for Education (BIE), had been identified as experienced users because they had successfully published a project in the state's peer-reviewed project library, and used PBL during the spring semester of SY2011. The survey responses of the final sample of 24 trained PBL-using teachers were compared to a matched group of teachers with similar backgrounds and teaching assignments who did not use PBL or who had used it but had limited or no professional development and had not participated in the BIE training" (Hixson, Ravitz, & Whisman, 2012, p. 4).

The original research conducted by the West Virginia Department of Education was influenced by teachers participating voluntarily in professional training and the study had a risk of self-selection bias. The original study sampled teachers trained in Project-

Based Learning in West Virginia. Samples included Mathematics, English, Social Studies and Science teachers. Stratified sampling was used to choose the participants. In the West Virginia study, responses were based on "teacher perceptions regarding a 'target class'; consequently, they do not necessarily represent the breadth of instruction provided by the sampled teachers in all of their course offerings. Due to relatively low sample sizes and small effect sizes, the achievement test analyses were afflicted by low statistical power" (Hixson, Ravitz, & Whisman, 2012, p. 5).

The sample size for this study will be increased in an attempt to gain more reliable statistics. The original study included Social Science and English teachers, whilst the focus of this study will be on Computer Applications Technology, Information Technology, Mathematics and Mathematical Literacy teachers. The subjects chosen for this study include data handling and problem-solving as part of their curriculum, which are seen as global skills by the Department of Basic Education in South Africa (Department of Basic Education, 2003).

This questionnaire was chosen because it is believed that it would disrupt the teachers the least when collecting data from a geographically spread group of teachers. The teacher was not taken out of class and teaching was not disturbed in any way. Several sections were included and the questionnaire started with a section which describes the constructs (see Addendum H – Questionnaire). Each section thereafter provides a description of the skills mentioned above, a list of associated procedures, and questions about how the teachers observe themselves teaching the skill.

A question about the understanding of each skill was added to ascertain whether participants were familiar with the skills or whether they only gave the expected answer. A description was given to ensure that all participants had the same perception of the concepts used. After each description, the questionnaire asks about the frequency of several practices referring to the teaching of a particular skill (e.g. "having students work in groups to support collaboration"). Response options were "1 'Almost never'; 2 'A few times a semester'; 3 '1-3 times per month'; 4 '1-3 times per week'; 5 'Almost daily'". The questionnaire also included questions about how often teachers teach and assess each identified global skill. As an example, the options for critical thinking were: "(a) I have tried to develop students' critical thinking skills; (b) Understanding of the skills mentioned; (c) Most students have learned critical thinking

skills while in my class; and, (d) I have been able to effectively assess students' critical thinking skills." Response options were "1 'Not really'; 2 'To a minor extent'; 3 'To a moderate extent'; 4 'To a great extent'; 5 'To a very great extent'" (see Addendum H – Questionnaire).

3.7.4 Data analysis

The aim of analysing data is to understand and visually represent huge amounts of data and communicate the outcomes observed from the data (Patton, 2015). The quantitative data collected via Google Forms in this study was exported to Google Sheets and cleaned by removing duplicates, converting numbers stored as text, removing extra spaces, etcetera. This was then imported into SPSS and calculations were done. The responses were summarised to be meaningful and to identify patterns and trends through the use of descriptive statistics; for example, using graphs, tables or charts. Internal consistency was tested through Cronbach's coefficient alpha test.

The data is presented by making use of the inferential and descriptive statistics including mean, median, mode, percentage, frequency, minimum, maximum and standard deviation. Data analysis includes, similar to the original questionnaire analysis, the

> "mean; numerical average of a set of values; the median: midpoint of a set of numerical values; the mode: most common value among a set of values, percentage: used to express how a value or group of respondents within the data relates to a larger group of respondents; the frequency: the number of times a value is found and the range: the highest and lowest value in a set of values"

as in the original study conducted by the West Virginia Department of Education (Hixson, Ravitz, & Whisman, 2012, p. 12).

Data analysis for this study also includes frequency tables, diagrams and relationships. The positivist approach attempts to explain relationships. Positivist researchers are challenged to identify reasons for behaviour and outcomes (Cresswell, 2014). The use of quantifiable data to "represent and analyse social reality is consistent with positivist epistemology" (Rehman & Alharthi, 2016, p. 101).

The data collected in this study was analysed and presented in two ways:

- Descriptive statistics: Bhattacharjee (2012) states that descriptive data helps describe, show or summarise data. Descriptive statistics allow the data to be visually presented with graphs and tables.
- Inferential statistics: Bhattacharjee (2012) explains that inferential statistics are used to determine relationships between different aspects. A Chi-square analysis was conducted to determine if a relationship exists between teaching with ICT and teaching 21st century skills.

3.8 TRUSTWORTHINESS

The most critical part of research and data analysis is validation to ensure trustworthiness (Marshall, 2016). Desimone (2009) states that the quality of the instrument increases or decreases prejudice. To avoid prejudice, the validity of the questionnaire was checked before the actual distribution and quantitative data was tested for reliability; that is, its internal consistency using the Cronbach's coefficient alpha test.

Quantitative researchers use the following methods used to establish trustworthiness: validity, reliability, objectivity and generalisation (Bryman, 2012).

Table 3.1: Criteria for evaluation of a Quantitative Study

Evaluating Criteria	Definition	Application in this study
Validity	Whether an indicator really measures the concept intended (Chiang, Jhangiani, & Price, 2015).	The questionnaire has been used in a previous study and has been proven valid (Shear, Novais, Means, Gallagher, & Langworthy, 2010). Definitions of concepts have been provided to participants, to avoid misinterpretation.
Credibility	Refers to the consistency of the measuring instruments (Price, Jhangiani, & Chiang, 2015).	This study's questionnaire was compiled using questionnaires found in literature. The collected data sets were cleaned and verified after capturing.

		Internal consistency was tested through Cronbach's coefficient alpha test. Testing includes credibility – to promote trust in the findings; transferability – to show that findings can be repeated in other research; dependability – to show consistent results; objectivity – to show neutral findings.
Objectivity	The appropriate distance between a researcher and participants which would decrease bias (Bhattacherjee, 2012).	The researcher did not have any contact with the participants, since the questionnaire was shared online. No bias was present.
Transferability	The findings should be generalised beyond the particular context in which the research was conducted (Almeida, Faria, & Queiros, 2017).	The sample selected is representative of the population and respondents have been randomly selected. Certain criteria were developed and the sample selected had to meet the criteria.

Malhotra (2010) states that a questionnaire should be pretested. This process ensures the validity and reliability of the questionnaire. This questionnaire was originally created by the International Innovative Teaching and Learning study and used in their research, therefore it has been tested. A pilot test was conducted for the questionnaire in this study and adjustments were made to ensure reliable results.

3.9 ETHICAL CONSIDERATIONS

Ethical issues within educational research have to be evident and should be seen as "an integral part of the research planning and implementation process" (Jones, 2000, p. 20).

This study complied with the ethical regulations as specified by the University of Johannesburg's Ethics Committee. Ethical approval was sought from the University's Ethics Committee (see Addendum B – Ethical Clearance Form University Of Johannesburg). The Gauteng Department of Education granted clearance to access

schools (see Addendum A – Letter Of Approval: Gauteng Education Department). The necessary protocols on entry at schools were abided by. An invitation letter as well as a consent form was made available by the researcher before participants completed the questionnaire.

The following rights, as specified by Oates (2006), were considered during data collection of this study:

- Voluntary participation – Respondents should be requested to participate in any study freely, without force or intimidation.
- Withdrawal – Respondents should be allowed to withdraw from taking part in any research any time they wish.
- Informed consent – Preceding the conducting of the research, an invitation letter as well as a consent form should stipulate how the responses collected would be used, and if any other persons could access the findings.
- Anonymity – No participant should be asked to identify himself/herself in any way. Identities and location should be withdrawn unless they provided permission for these details to be disclosed.

The following measures were taken to guarantee that ethical considerations were observed:

- The Research Ethics Committee of the University of Johannesburg approved the study (see Addendum B – Ethical Clearance Form University Of Johannesburg).
- Ethical clearance was obtained from the Gauteng Department of Education (see Addendum A – Letter Of Approval: Gauteng Education Department).
- Principals were approached for permission to conduct the study in their schools (see Addendum E – Letter To Principal).
- Consent forms were distributed included with the distribution of the questionnaire (see Addendum G – Consent Form).
- Voluntarily participation – Participants were encouraged to participate in this study by completing the questionnaire in their own safe space and time (see Addendum F – Invitation Letter To Participants).

- Informed consent – Participants were informed of how the data collected would be used. If any third parties might need access to the data, participants would be informed (see Addendum F – Invitation Letter To Participants).
- Anonymity – No identification was required. If any data should be disclosed, explicit permission would be requested (see Addendum F – Invitation Letter To Participants).
- Withdrawal – Any participant who wished to withdraw at any time during the study was be allowed to do so (see Addendum F – Invitation Letter To Participants).
- Use of results – Data gathered would only be used for the intention of this study and did not exceed the purpose of this study (see Addendum F – Invitation Letter To Participants).
- The raw data would be privately and secured stored and proper security measures were put in place.

3.10 SUMMARY OF CHAPTER

This chapter provided a detailed explanation of the way this research was conducted. The Research Onion as proposed by Saunders (2012), was followed. The first point of discussion was that this study would be using the Critical Realism paradigm combined with the ICT4D paradigm. In harmony with this paradigm, a deductive research approach was used for this study. A quantitative data collection process was used. The next section identified the research choice being survey research which used an existing questionnaire to gather the necessary data. The choice of population and sampling was discussed and data collection methods were described. The data analysis and trustworthiness issues were discussed after which the chapter concluded with a list of the ethical issues considered as applicable to this study. As this chapter has described the research design and methods, the next chapter will report on the findings and analysis of the process.

CHAPTER 4 – DATA GATHERING AND ANALYSIS

4.1 INTRODUCTION

In Chapter 3 the method used to collect data was discussed based on the Saunders Research Onion (Saunders, Lewis, & Thornhill, 2012). The positivist paradigm, quantitative research, and how these relate to this study, were explained. The questionnaire survey research strategy, and its use in this research, was explored. Data collection strategies and data analysis methods have been clarified, and the population and method of sampling of the study were defined. Lastly, ethical considerations were discussed.

This chapter begins by providing the demographics of the teachers and schools that participated in the study. The descriptive statistics of the questionnaire, which discusses the outcomes of the data collection, follows. Furthermore, the research problem and research questions were investigated to explain what the research and data collection methods intended to investigate. The outcomes of the data are presented.

Figure 4.1 presents an outline of this chapter:

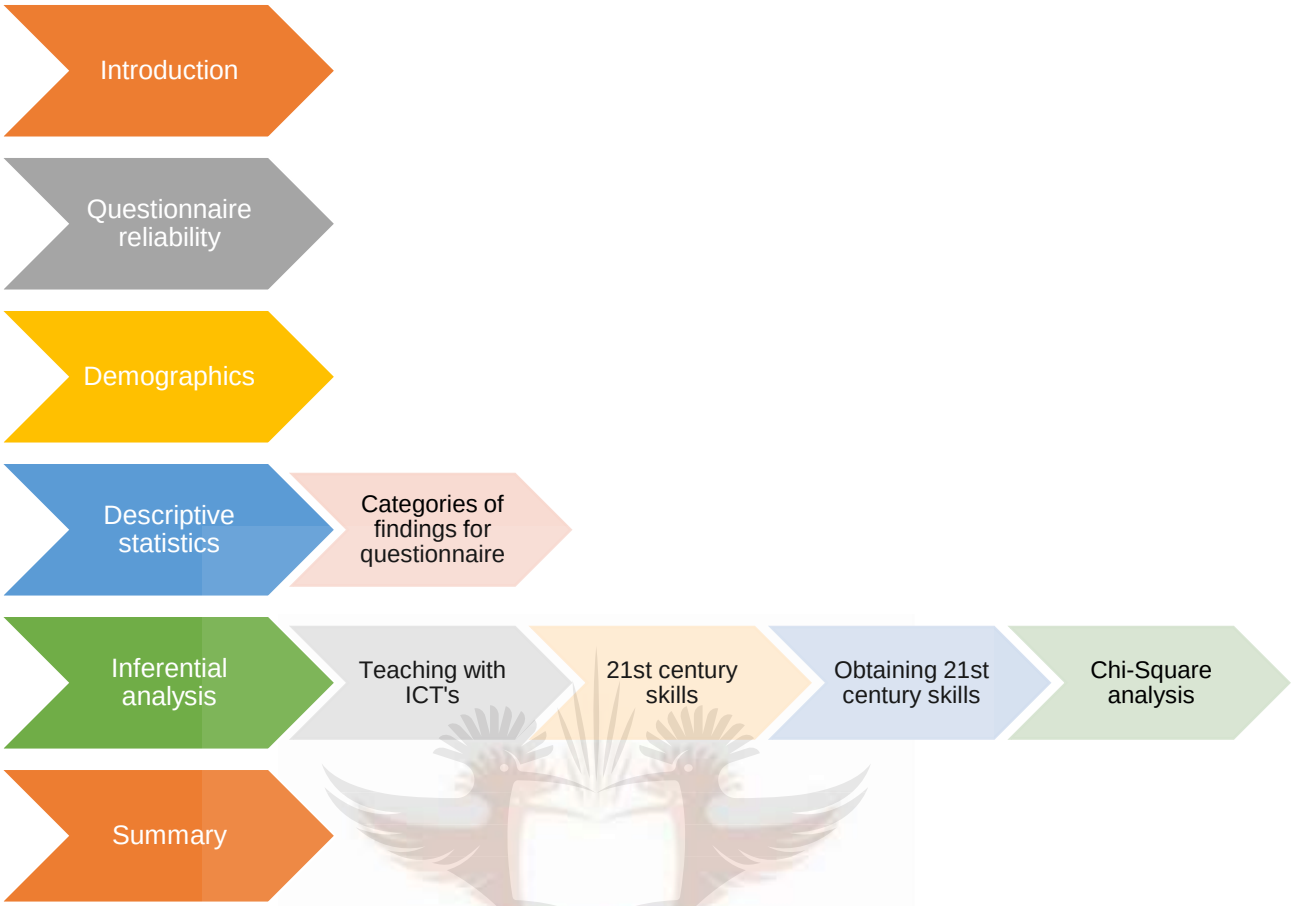

Figure 4.1: Outline of Chapter 4

Data analysis is defined by Corbin & Straus (2015, p. 81) as "the act of interpreting data for meaning." Bhattacherjee (2012, p. 87) states that numeric data collected can be "analysed quantitatively using statistical tools in two different ways." **Descriptive** analysis refers to explaining and displaying the associations between concepts statistically. **Inferential** analysis refers to methods used to reach statistical findings about relationships between variables (Bhattacherjee, 2012).

The response rate of the study refers to the percentage of respondents who completed the survey from the total study population (The American Association for Public Opinion Research, 2015). The American Association for Public Opinion Research (2015) suggests the following calculation to determine the response rate:

$$\frac{The\ number\ of\ completed\ questionnaires}{The\ number\ of\ eligible\ questionnaires}$$

Figure 4.2: Response Rate Equation

In this study, 100 responses were planned, but as the survey was remotely conducted and the questionnaire was emailed, 132 participants were approached. Of the 132 participants approached, 104 responses were collected, achieving a response rate of 78.7%. The response rate was boosted by contacting prospective respondents before they received the questionnaire and following up at least three times with non-respondents. Yun and Trumbo (2000) believe that web surveys using online questionnaires or emailing questionnaires can boost response rates.

4.2 QUESTIONNAIRE RELIABILITY

The study made use of Cronbach's alpha coefficient to test reliability. Alpha is used when the questionnaire has a Likert-scale and is based on the correlation of each item with every other item (Leech, Barrett, & Morgan, 2005). Leech, Barrett and Morgan (2005) state that 0.700 or above indicates good reliability of the instrument. The table below indicates that the total Cronbach's alpha for the study was 0.978.

Table 4.1: Cronbach's alpha

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.978	.978	80

4.3 DEMOGRAPHICS

This section discusses the attributes that describe the 104 respondents who participated in this study. Table 4.2: Demographics of respondents provides descriptive aggregated summaries of the demographic attributes.

Table 4.2: Demographics of Respondents

Demographic attribute	*Category*	*Number*	*Percentage*
Gender	Male	25	24.0%
	Female	79	76.0%
	Total (n)	**104**	**100%**
Age	20 - 25 years	4	3.8%
	26 - 30 years	18	17.3%

Demographic attribute	*Category*	*Number*	*Percentage*
	31 - 35 years	24	23.1%
	36 - 40 years	12	11.5%
	41 - 45 years	6	5.8%
	46 - 50 years	15	14.4%
	51 - 55 years	12	11.5%
	56 - 60 years	9	8.7%
	61 - 65 years	4	3.8%
	Total (n)	**104**	**100%**
Highest teaching qualification	Postgraduate Certificate in Education	29	27.9%
	Bachelor's Degree in Education	62	59.6%
	Bachelor of Education: Honours	12	11.5%
	Master's Degree in Education	1	1.0%
	Total (n)	**104**	**100%**
Grades taught	Grade 8	20	19.2%
	Grade 9	21	20.2%
	Grade 10	74	71.2%
	Grade 11	87	83.7%
	Grade 12	88	84.6%
Subjects taught	Computer Applications Technology	70	67.3%
	Information Technology	13	12.5%
	Mathematics	32	30.8%
	Mathematical Literacy	12	11.5%
	Other	25	24.0%
Years of teaching	0 - 10 years	43	41.3%
	11 - 20 years	29	27.9%
	21 - 30 years	16	15.4%
	31 - 40 years	16	15.4%
	Total (n)	**104**	**100%**
Years teaching with ICT	0 - 5 years	33	31.7%
	6 - 10 years	36	34.6%
	11 - 15 years	20	19.2%
	16 - 20 years	9	8.7%

Demographic attribute	*Category*	*Number*	*Percentage*
	21 - 25 years	4	3.8%
	26 - 30 years	2	1.9%
	Total (n)	**104**	**100%**
Type of school	Public	98	94.2%
	Private/Independent	6	5.8%
	Total (n)	**104**	**100%**

The gender distribution indicated that the majority (76%) of respondents were female and 24% were male. Therefore, there were comparatively fewer male respondents in the study. This imbalance reflects the skewedness in the recruitment of teachers in South Africa where more women (70.3%) are employed as teachers than males (29.7%) (Department of Basic Education, 2018). This contradicts the view of Makarova, Aeschlimann and Herzog (2019) that STEM subjects are seen as male subjects and that gender discrimination will remain in the education market (OECD, 2017).

Most teachers (61.5%) fell into the 20 to 45 years age group. Of this age group, 21.2% were aged between 20 to 30 years. Only 3.8% of respondents fell above 60 years of age. This could be due to the current prescribed retirement age of 60 year. Figure 4.3 below depicts the age distribution of respondents.

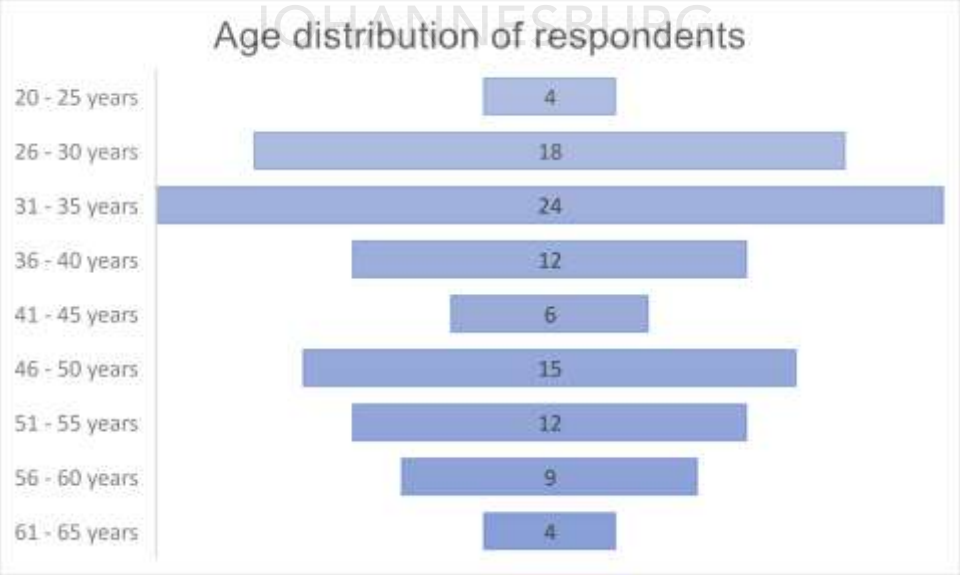

Figure 4.3: Age Distribution of Respondents

The demographics show that a high number of teachers were young and middle-aged female adults (see Table 4.2). Teachers need to be comfortable with the use of ICT and Ghavifekr and Rosdy (2015) found that even though most teachers think ICT integration is effective, there are many challenges regarding the integration of ICT in teaching. Some challenges are: poor ICT infrastructure, poor technical support and training is not adequate (Department of Communications & Digital Technologies, 2020).

Table 4.2: Demographics of respondents demonstrates that a significant percentage (59.6%) of teachers have a B.Ed. as their highest qualification, followed by those who have attained a Postgraduate Certificate in Education (PGCE) (27.9%). A small percentage (11.5%) of respondents had a Bachelor of Education: Honours and only 1% of respondents had a master's degree in Education as their highest teaching qualification.

The majority of respondents as shown in Table 4.2: Demographics of Respondents teach in the Further Education and Training band (FET). Many schools use teachers from the FET band to also teach in the General Education and Training band. It is clear that teachers teach across different grades and different bands, therefore specialisation is not always accomplished.

Most respondents teach Computer Applications Technology (67.3%) followed by Mathematics (30.8%) and then Information Technology (12.5%) and Mathematical Literacy (11.5%) as seen in Table 4.2: Demographics of respondents. Thirty out of 104 respondents (29%), almost one third, teach more than one subject. This proves the fact that specialisation of subjects is difficult to achieve.

The results indicate that almost half (41.3%) of respondents have been teaching for 10 years or less, 27.9% between 11 and 20 years while 30.8% of respondents have been teaching for more than 20 years. A significant number of teachers have been teaching for less than 10 years, which means a high number of teachers are still early in their teaching career.

Table 4.2: Demographics of Respondents further shows that 31.7% of teachers indicated that they had up to five years of ICT teaching experience and 34.6% had 6 to 10 years of experience of using ICT in their classrooms. This sample was taken from the Gauteng Province and the high number of ICT use could be the result of the

Gauteng Education Department providing laptops, whiteboards, tablets and computers to schools, as strategised in Pillar 6 of the Gauteng 10-Pillar Programme of Transformation, Modernisation and Reindustrialisation (TMR) strategy (Gauteng Department of Education, 2015).

Schools approached were from the Ekurhuleni South, Gauteng West and Sedibeng West districts. Schools were spread out in the south and west of Gauteng as shown in the figure below.

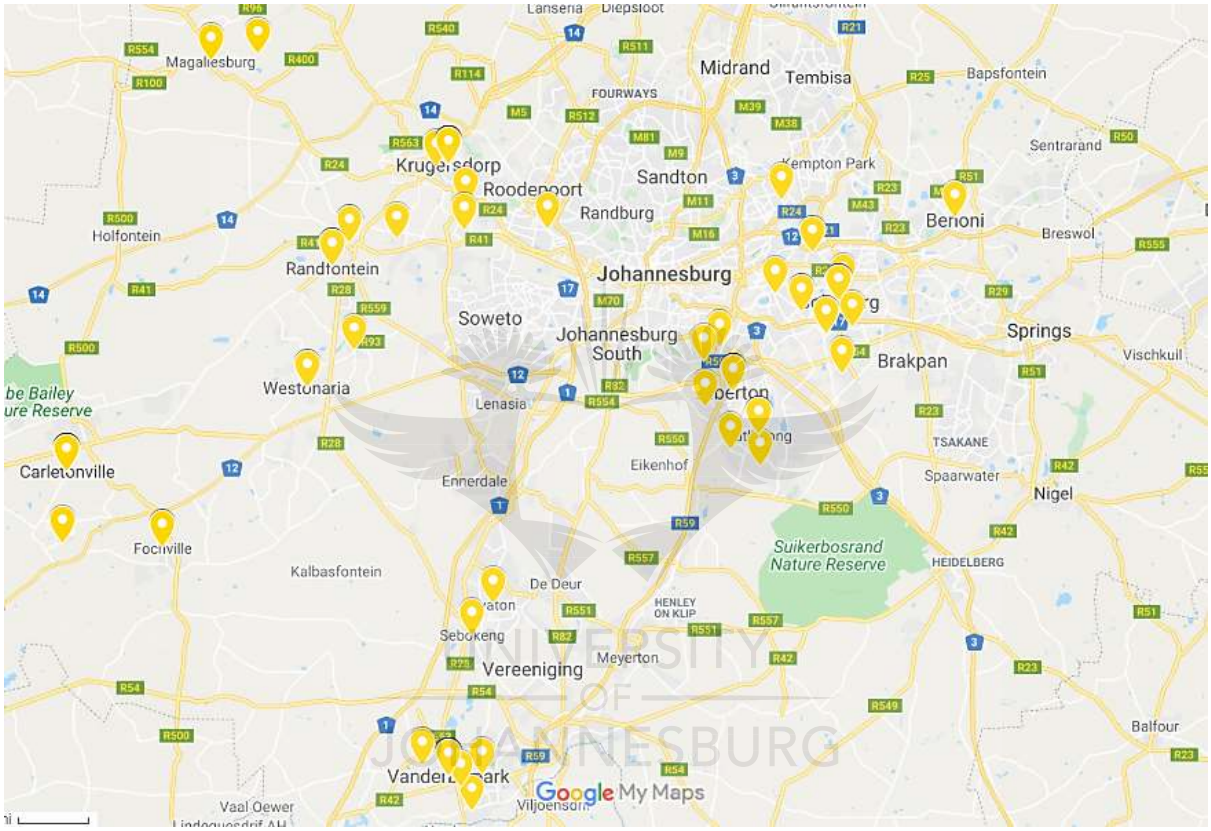

Figure 4.4: School Locations

Two school types were identified according to Table 4.2: Demographics of respondents: Public or Private/Independent. The sample selected was only from secondary schools. Almost all (94.2%) of the respondents were from public schools while 5.8% were from private or independent schools. This correlates with the national profile of 95.5% being public schools and 4.5% private or independent schools (Department of Basic Education, 2018).

4.4 DESCRIPTIVE STATISTICS

Descriptive statistics refer to a set of techniques for summarising the data obtained from an instrument, which in this study, is the questionnaire (Price, Jhangiani, &

Chiang, 2015). Descriptions of respondents' selections for each of the questions in the questionnaire linking to the aims of this study are presented in this section. Respondents were asked to select the items by choosing the option that they most agreed with on a Likert scale ranging from "almost never, a few times a term, one to three times per month, one to three times per week and almost daily" for the first question and "not really, to a minor extent, to a moderate extent, to a great extent and to a very great extent" for other questions. For each ICT skill, definitions were provided and respondents were requested to select the one they most agreed with.

4.4.1 Categories of findings for questionnaire

The previous section presented the results from the demographic information, response rate and reliability of the questionnaire. This section discusses the questionnaire findings on the various sections that were identified regarding how teachers perceive themselves teaching ICT skills.

The data that was collected through the questionnaire was analysed by frequency counts. The participants' choices for each question per section were added up to find which option occurred the most (thus, how many times a specific choice occurs). These responses to the questions, were coded and then presented in percentage form.

4.4.1.1 Critical thinking skills

The questionnaire defines critical thinking skills as: "Critical thinking skills refer to students being able to analyse complex problems, investigate questions for which there are no clear-cut answers, evaluate different points of view or sources of information, and draw appropriate conclusions based on evidence and reasoning."

Table 4.3: Statistics for Teaching Critical Thinking Skills

Critical Thinking: Statistics for how often have you asked students to do the following?

		Compare information from different sources before completing a task or assignment?	Draw their own conclusions based on analysis of numbers, facts, or relevant information?	Summarise or create their own interpretation of what they have read or been taught?	Analyse competing arguments, perspectives or solutions to a problem?	Develop a persuasive argument based on supporting evidence or reasoning?	Try to solve complex problems or answer questions that have no single correct solution or answer?
N	Valid	104	104	104	104	104	104
	Missing	0	0	0	0	0	0
Mean		2.84	3.06	3.13	2.95	2.90	3.05

Critical Thinking: Statistics for how often have you asked students to do the following?

	Compare information from different sources before completing a task or assignment?	Draw their own conclusions based on analysis of numbers, facts, or relevant information?	Summarise or create their own interpretation of what they have read or been taught?	Analyse competing arguments, perspectives or solutions to a problem?	Develop a persuasive argument based on supporting evidence or reasoning?	Try to solve complex problems or answer questions that have no single correct solution or answer?
Median	3.00	3.00	3.00	3.00	3.00	3.00
Mode	2	2	2	2	2	3
Std. Deviation	1.200	1.087	1.175	1.226	1.195	1.303
Minimum	1	1	1	1	1	1
Maximum	5	5	5	5	5	5

The coding for participant's understanding of critical thinking skills is as follows: 1 = almost never, 2 = a few times a term, 3 = one to three times per month, 4 = one to three times per week, 5 = almost daily. The most frequent instruction regarding critical thinking (based on the mean) was to create their own opinion of what they have read or been taught ($\overline{X}$ = 3,13 ± 1,18) while the least frequent instruction was to compare information from different sources before completing a task or assignment ($\overline{X}$ = 2,84 ± 1,20). The most frequent instruction regarding critical thinking (based on the mode) was to try solve problems or answer questions that have no single correct solution or answer (mode = 3, which was one to three times per month), while the other instructions were less frequent (mode = 2, which was a few times a term).

Table 4.4: Understanding of Critical Thinking Skills

2. What is your understanding of 'critical thinking skills'?

		Frequency	Percent	Valid Percent
Valid	A process by which we use our knowledge and intelligence to effectively arrive at the most reasonable positions on issues	5	4.8	4.8
	Critical thinking is reasonable, reflective thinking that is focused on deciding what to believe or do	5	4.8	4.8
	Critical thinking refers to the ability to analyse information objectively and make a reasoned judgment. It involves the evaluation of sources, such as data, facts, observable phenomena, and research findings	93	89.4	89.4
	Critical thinking is thinking about your thinking, while you're thinking, in order to make your thinking better	1	1.0	1.0
	Total	104	100.0	100.0

Most participants (89.4%) said that their understanding of critical thinking is that "critical thinking refers to the ability to analyse information objectively and make a

reasoned judgment. It involves the evaluation of sources, such as data, facts, observable phenomena, and research findings."

Table 4.5: Developing Critical Thinking Skills

3. To what extent do you agree with these statements about your class?

I have tried to develop students' critical thinking skills

		Frequency	Percent	Valid Percent
Valid	To a minor extent	11	10.6	10.6
	To a moderate extent	41	39.4	39.4
	To a great extent	42	40.4	40.4
	To a very great extent	10	9.6	9.6
	Total	104	100.0	100.0

Most participants (40.4%) agreed to a great extent.

Table 4.6: Statistics for Development of Critical Thinking Skills

Critical Thinking: Statistics for the extent of agreement to the following statements

		I have tried to develop students' critical thinking skills	Most students have learned critical thinking skills while in my class	I have been able to effectively assess students' critical thinking skills
N	Valid	104	104	104
	Missing	0	0	0
Mean		3.49	2.96	2.89
Median		3.50	3.00	3.00
Mode		4	3	3
Std. Deviation		.812	.835	.954
Minimum		2	1	1
Maximum		5	5	5

The coding for participants' understanding of critical thinking skills is as follows: 1 = not really, 2 = to a minor extent, 3 = to a moderate extent, 4 = to a great extent, 5 = to a very great extent. The most prevalent critical thinking statement (based on the mean) was to have tried to develop students' critical thinking skills ($\bar{X}$ = 3,49 ± 0,81) while the least agreed upon statement was to have been able to effectively assess students' critical thinking skills ($\bar{X}$ = 2,89 ± 0,95). The most frequently agreed upon critical thinking statement (based on the mode) was to have tried to develop students' critical thinking skills (mode = 4, which was to a great extent), while the other statements were less prevalent (mode = 3, which was to a moderate extent).

4.4.1.2 Collaboration skills

The questionnaire defines collaboration skills as: "Collaboration skills refer to students being able to work together to solve problems or answer questions, to work effectively and respectfully in teams to accomplish a common goal and to assume shared responsibility for completing a task."

Table 4.7: Statistics for Teaching Collaboration Skills

Collaboration Skills: Statistics for how often have you asked students to do the following?

		Work in pairs or small groups to complete a task together?	Work with other students to set goals and create a plan for their team?	Create joint products using contributions from each student?	Present their group work to the class, teacher or others?	Work as a team to incorporate feedback on group tasks or products?	Give feedback to peers or assess other students' work?
N	Valid	104	104	104	104	104	104
	Missing	0	0	0	0	0	0
Mean		2.27	2.10	1.99	1.94	1.96	2.17
Median		2.00	2.00	2.00	2.00	2.00	2.00
Mode		2	2	2	1	1	2
Std. Deviation		1.090	.950	1.075	.993	1.079	1.047
Minimum		1	1	1	1	1	1
Maximum		5	5	5	5	5	5

The coding for participants' understanding of collaboration skills is as follows: 1 = almost never, 2 = a few times a term, 3 = one to three times per month, 4 = one to three times per week, 5 = almost daily. The most frequent choice regarding collaboration skills (based on the mean) was to work in pairs or small groups to complete a task together ($\bar{X}$ = 2,27 ± 1,09) while the least frequent choice was to "present their group work to the class, teacher or others" ($\bar{X}$ = 1,94 ± 0,99).

The most frequent choices regarding collaboration (based on the mode) were "to work in pairs or small groups to complete a task together, to work with other students to set goals and create a plan for their team, to create joint products using contributions from each student, to give feedback to peers or assess other students' work" (mode = 2, which was a few times a term), while the other instructions were less frequent (mode = 1, which was almost never).

Table 4.8: Understanding of Collaboration Skills

2. What is your understanding of 'collaboration skills'?

		Frequency	Percent	Valid Percent
Valid	Knowing how to cooperate well with others will support workplace efficiency, aid in career advancement and help you and your team achieve better outcomes	19	18.3	18.3
	The behaviours that help two or more people work together and function well in the process	14	13.5	13.5
	Working in teams, negotiating, communicating, motivating others and following orders	26	25.0	25.0
	Collaboration depends largely on the ability to simply join in, to commit yourself to working with others, listening to what others have to say and encouraging them to speak up and speaking up yourself when you have an idea or opinion	45	43.3	43.3
	Total	104	100.0	100.0

Most participants (43.3%) said that their understanding of collaboration skills was that "collaboration depends largely on the ability to simply join in, to commit yourself to working with others, listening to what others have to say and encouraging them to speak up and speaking up yourself when you have an idea or opinion."

Table 4.9: Develop Collaboration Skills

3. To what extent do you agree with these statements about your class?

I have tried to develop students' collaboration skills

		Frequency	Percent	Valid Percent
Valid	Not really	7	6.7	6.7
	To a minor extent	40	38.5	38.5
	To a moderate extent	37	35.6	35.6
	To a great extent	16	15.4	15.4
	To a very great extent	4	3.8	3.8
	Total	104	100.0	100.0

Most participants (38.5%) agreed to a minor extent.

Table 4.10: Statistics for Development of Collaboration Skills

Collaboration: Statistics for the extent of agreement to the following statements

		I have tried to develop students' collaboration skills	Most students have learned collaboration skills while in my class	I have been able to effectively assess students' collaboration skills
N	Valid	104	104	104
	Missing	0	0	0

Collaboration: Statistics for the extent of agreement to the following statements

	I have tried to develop students' collaboration skills	Most students have learned collaboration skills while in my class	I have been able to effectively assess students' collaboration skills
Mean	2.71	2.50	2.27
Median	3.00	2.00	2.00
Mode	2	2	2
Std. Deviation	.942	.914	.968
Minimum	1	1	1
Maximum	5	5	5

The coding for participants' understanding of collaboration skills is as follows: 1 = not really, 2 = to a minor extent, 3 = to a moderate extent, 4 = to a great extent, 5 = to a very great extent. The most prevalent collaboration skills statement (based on the mean) was to have tried to develop student's collaboration skills ($\bar{X}$ = 2,71 ± 0,94) while the least prevalent statement was "I have been able to effectively assess students' collaboration skills" ($\bar{X}$ = 2,27 ± 0,97). Based on the mode, all three collaboration skills' statements were agreed upon to a minor extent (mode = 2).

4.4.1.3 Communication skills

The questionnaire defines communication skills as: "Communication skills refer to students being able to organise their thoughts, data and findings and share these effectively through a variety of media, as well as orally and in writing."

Table 4.11 Statistics for Teaching Communication Skills

Communication Skills: Statistics for how often have you asked students to do the following?

		Structure data for use in written products or oral presentations (e.g., creating charts, tables or graphs)?	Convey their ideas using media other than a written paper (e.g., posters, video, blogs, etc.)?	Prepare and deliver an oral presentation to the teacher or others?	Answer questions in front of an audience?	Decide how they will present their work or demonstrate their learning?
N	Valid	104	104	104	104	104
	Missing	0	0	0	0	0
Mean		2.91	2.33	1.88	2.95	2.32
Median		3.00	2.00	2.00	3.00	2.00
Mode		2	2	1	1	2
Std. Deviation		1.116	1.136	1.058	1.457	1.126
Minimum		1	1	1	1	1
Maximum		5	5	5	5	5

The coding for participants' understanding of communication skills is as follows: 1 = almost never, 2 = a few times a term, 3 = one to three times per month, 4 = one to three times per week, 5 = almost daily. The most frequent instruction regarding communication skills (based on the mean) was answering questions in front of an audience ($\overline{X}$ = 2,95 ± 1,46) while the least frequent instruction was to prepare and deliver an oral presentation to the teacher or others ($\overline{X}$ = 1,88 ± 1,06).

The most frequent instructions regarding communication (based on the mode) was: "To structure data for use in written products or oral presentations, To convey their ideas using media other than a written paper, To decide how they will present their work or demonstrate their learning" (mode = 2, which was a few times a term), while the other instructions were less frequent (mode = 1, which was almost never).

Table 4.12: Understanding of Communication Skills

2. What is your understanding of 'communication skills'?

		Frequency	Percent	Valid Percent
Valid	Every communication involves one sender, a message and a recipient	5	4.8	4.8
	The ability to convey information to another effectively and efficiently	48	46.2	46.2
	Communication is simply the act of transferring information from one place, person or group to another	15	14.4	14.4
	The successful conveying or sharing of ideas and feelings	36	34.6	34.6
	Total	104	100.0	100.0

Most participants (46.2%) said that their understanding of communication skills was that communication is the ability to convey information to another effectively and efficiently.

Table 4.13: Developing Communication Skills

3. To what extent do you agree with these statements about your class?

I have tried to develop students' communication skills

		Frequency	Percent	Valid Percent
Valid	Not really	1	1.0	1.0
	To a minor extent	20	19.2	19.2
	To a moderate extent	36	34.6	34.6
	To a great extent	34	32.7	32.7
	To a very great extent	13	12.5	12.5
	Total	104	100.0	100.0

Most participants (34.6%) agreed to a moderate extent.

Table 4.14: Statistics for Development of Communication Skills

Communication: Statistics for the extent of agreement to the following statements

		I have tried to develop students' communication skills	Most students have learned communication skills while in my class	I have been able to effectively assess students' communication skills
N	Valid	104	104	104
	Missing	0	0	0
Mean		3.37	3.03	2.80
Median		3.00	3.00	3.00
Mode		3	3	3
Std. Deviation		.966	.980	1.065
Minimum		1	1	1
Maximum		5	5	5

The coding for participants' understanding of communication skills is as follows: 1 = not really, 2 = to a minor extent, 3 = to a moderate extent, 4 = to a great extent, 5 = to a very great extent. The most prevalent communication skills statement (based on the mean) was to have tried to develop student's communication skills ($\bar{X}$ = 3,37 ± 0,97) while the least prevalent statement was to have been able to effectively assess students' communication skills ($\bar{X}$ = 2,80 ± 1,07). Based on the mode, all three communication skills statements were agreed upon to a moderate extent (mode = 3).

4.4.1.4 Creativity and innovation skills

The questionnaire defines creativity and innovation skills as: "Creativity and innovation skills refer to students being able to generate and refine solutions to complex problems or tasks based on synthesis, analysis and then combining or presenting what they have learned in new and original ways."

Table 4.15: Statistics for teaching Creativity and Innovation Skills

Creativity and Innovation Skills: Statistics for how often have you asked students to do the following?

		Use idea creation techniques such as brainstorming or concept mapping?	Generate their own ideas about how to confront a problem or question?	Test out different ideas and work to improve them?	Invent a solution to a complex, open-ended question or problem?	Create an original product or performance to express their ideas?
N	Valid	104	104	104	104	104
	Missing	0	0	0	0	0
Mean		2.58	2.96	2.89	2.78	2.55
Median		2.00	3.00	3.00	3.00	2.00

Creativity and Innovation Skills: Statistics for how often have you asked students to do the following?

	Use idea creation techniques such as brainstorming or concept mapping?	Generate their own ideas about how to confront a problem or question?	Test out different ideas and work to improve them?	Invent a solution to a complex, open-ended question or problem?	Create an original product or performance to express their ideas?
Mode	2	2	2	2	2
Std. Deviation	1.138	1.148	1.165	1.149	1.198
Minimum	1	1	1	1	1
Maximum	5	5	5	5	5

The coding for participants' understanding of creativity and innovation skills is as follows: 1 = almost never, 2 = a few times a term, 3 = one to three times per month, 4 = one to three times per week, 5 = almost daily. The most frequent instruction regarding creativity and innovation skills (based on the mean) was to generate their own ideas about how to confront a problem or question ($\bar{X}$ = 2,96 ± 1,15) while the least frequent instruction was to create an original product or performance to express their ideas ($\bar{X}$ = 2,55 ± 1,20). Based on the mode, all creativity and innovation instructions were carried out a few times a term (mode = 2).

Table 4.16: Understanding of Creativity and Innovation Skills

2. What is your understanding of 'creativity and innovation skills'?

		Frequency	Percent	Valid Percent
Valid	The ability to connect the seemingly unconnected	3	2.9	2.9
	Creativity is characterised by the ability to perceive the world in new ways	34	32.7	32.7
	Creativity is the act of turning new and imaginative ideas into reality	62	59.6	59.6
	If you are able to make something, you are creative	5	4.8	4.8
	Total	104	100.0	100.0

Most participants (59.6%) said that their understanding of creativity and innovation skills was that "creativity is the act of turning new and imaginative ideas into reality."

Table 4.17: Developing Creativity and Innovation Skills

3. To what extent do you agree with these statements about your class?

I have tried to develop students' creativity and innovation skills

		Frequency	Percent	Valid Percent
Valid	Not really	4	3.8	3.8
	To a minor extent	20	19.2	19.2

3. To what extent do you agree with these statements about your class?

I have tried to develop students' creativity and innovation skills

	Frequency	Percent	Valid Percent
To a moderate extent	44	42.3	42.3
To a great extent	30	28.8	28.8
To a very great extent	6	5.8	5.8
Total	104	100.0	100.0

Most participants (42.3%) agreed to a moderate extent.

Table 4.18: Statistics for Development of Creativity and Innovation Skills

Creativity and Innovation Skills: Statistics for the extent of agreement to the following statements

		I have tried to develop students' creativity and innovation skills	Most students have learned creativity and innovation skills while in my class	I have been able to effectively assess students' creativity and innovation skills
N	Valid	104	104	104
	Missing	0	0	0
Mean		3.13	2.77	2.73
Median		3.00	3.00	3.00
Mode		3	3	3
Std. Deviation		.925	.916	1.036
Minimum		1	1	1
Maximum		5	5	5

The coding for participants' understanding of creativity and innovation skills is as follows: 1 = not really, 2 = to a minor extent, 3 = to a moderate extent, 4 = to a great extent, 5 = to a very great extent. The most prevalent creativity and innovation skills statement (based on the mean) was to have tried to develop students' creativity and innovation skills ($\bar{X}$ = 3,13 ± 0,93) while the least prevalent statement was "I have been able to effectively assess students' creativity and innovation skills" ($\bar{X}$ = 2,73 ± 1,04). Based on the mode, all three creativity and innovation skills' statements were agreed upon to a moderate extent (mode = 3).

4.4.1.5 Self-direction skills

The questionnaire defines self-direction skills as: "Self-direction skills refer to students being able to take responsibility for their learning by identifying topics to pursue and processes for their own learning and being able to review their own work and respond to feedback."

Table 4.19: Statistics for Teaching Self-direction Skills

Self-Direction Skills: Statistics for how often have you asked students to do the following?

		Take initiative when confronted with a difficult problem or question?	Choose their own topics of learning or questions to pursue?	Plan the steps they will take to accomplish a complex task?	Choose for themselves what examples to study or resources to use?	Monitor their own progress towards completion of a complex task and modify their work accordingly?	Use specific criteria to assess the quality of their work before it is completed?	Use peer, teacher or expert feedback to revise their work?
N	Valid	104	104	104	104	104	104	104
	Missing	0	0	0	0	0	0	0
Mean		3.32	2.39	3.18	2.70	2.84	2.96	3.05
Median		3.00	2.00	3.00	3.00	3.00	3.00	3.00
Mode		2	2	2	2	2	3	3
Std. Deviation		1.201	1.218	1.298	1.140	1.167	1.140	1.135
Minimum		1	1	1	1	1	1	1
Maximum		5	5	5	5	5	5	5

The coding for participants' understanding of self-direction skills is as follows: 1 = almost never, 2 = a few times a term, 3 = one to three times per month, 4 = one to three times per week, 5 = almost daily. The most frequent instruction regarding self-direction skills (based on the mean) was to take initiative when confronted with a difficult problem or question ($\overline{X}$ = 3,32 ± 1,20) while the least frequent instruction was to choose their own topics of learning or questions to pursue ($\overline{X}$ = 2,39 ± 1,22). The most frequent instructions regarding self-direction (based on the mode) was to use specific criteria to assess the quality of their work before it is completed and to use peer, teacher or expert feedback to revise their work (mode = 3, which was one to three times per month), while the other instructions were less frequent (mode = 2, which was a few times a term).

Table 4.20: Understanding of Self-direction Skills

2. What is your understanding of 'self-direction skills'?

		Frequency	Percent	Valid Percent
Valid	The ability to manage tasks without having them directed by others	8	7.7	7.7
	A process by which individuals take the initiative, with or without the assistance of others	58	55.8	55.8
	Self-direction is enhanced in social contexts and we need social skills to be able to interact with those who can help us achieve	16	15.4	15.4
	A continuous engagement in acquiring, applying and creating knowledge and skills	22	21.2	21.2
	Total	104	100.0	100.0

Most participants (55.8%) said that their understanding of self-direction skills was that "it's a process by which individuals take the initiative, with or without the assistance of others."

Table 4.21: Developing Self-direction Skills

3. To what extent do you agree with these statements about your class?

I have tried to develop students' self-direction skills

		Frequency	Percent	Valid Percent
Valid	Not really	5	4.8	4.8
	To a minor extent	25	24.0	24.0
	To a moderate extent	30	28.8	28.8
	To a great extent	31	29.8	29.8
	To a very great extent	13	12.5	12.5
	Total	104	100.0	100.0

Most participants (29.8%) agreed to a great extent.

Table 4.22: Statistics for Development of Self-direction Skills

Self-direction Skills: Statistics for the extent of agreement to the following statements

		I have tried to develop students' self-direction skills	Most students have learned self-direction skills while in my class	I have been able to effectively assess students' self-direction skills
N	Valid	104	104	104
	Missing	0	0	0
Mean		3.21	2.79	2.73
Median		3.00	3.00	3.00
Mode		4	3	3
Std. Deviation		1.094	.982	1.036
Minimum		1	1	1
Maximum		5	5	5

The coding for participants' understanding of self-direction skills is as follows: 1 = not really, 2 = to a minor extent, 3 = to a moderate extent, 4 = to a great extent, 5 = to a very great extent. The most frequent self-direction statement (based on the mean) was to have tried to develop student's self-direction skills ($\bar{X}$ = 3,21 ± 1,10) while the least agreed upon statement was to have been able to effectively assess students' self-direction skills ($\bar{X}$ = 2,73 ± 1,04). The most frequently agreed upon self-direction statement (based on the mode) was to have tried to develop students' self-direction skills (mode = 4, which was to a great extent), while the other statements were less frequent (mode = 3, which was to a moderate extent).

4.4.1.6 Global connections

The questionnaire defines global connections as: "Global connections refer to students being able to understand global, geo-political issues including awareness of geography, culture, language, history, and literature from other countries."

Table 4.23: Statistics for Teaching Global Connections

Global connections: Statistics for how often have you asked students to do the following?

		Study information about other countries or cultures?	Use information or ideas that come from people in other countries or cultures?	Discuss issues related to global interdependency (for example, global environment trends, global market economy)?	Understand the life experiences of people in cultures besides their own?	Study the geography of distant countries?	Reflect on how their own experiences and local issues connected to global issues?
N	Valid	104	104	104	104	104	104
	Missing	0	0	0	0	0	0
Mean		1.90	2.04	2.40	2.22	1.77	2.23
Median		2.00	2.00	2.00	2.00	1.00	2.00
Mode		1	1	2	2	1	1[a]
Std. Deviation		1.128	1.222	1.311	1.198	.988	1.256
Minimum		1	1	1	1	1	1
Maximum		5	5	5	5	5	5

a. Multiple modes exist. The smallest value is shown.

The coding for participants' understanding of global connections is as follows: 1 = almost never, 2 = a few times a term, 3 = one to three times per month, 4 = one to three times per week, 5 = almost daily. The most frequent instruction regarding global connections (based on the mean) was to discuss issues related to global interdependency ($\bar{X}$ = 2,40 ± 1,31) while the least frequent instruction was to study the geography of distant countries ($\bar{X}$ = 1,77 ± 0,99). The most frequent instructions regarding local connections (based on the mode) was to discuss issues related to global interdependency and to understand the life experiences of people in cultures besides your own (mode = 2, which was a few times a term), while the other instructions were less frequent (mode = 1, which was almost never).

Table 4.24: Understanding of Global Connections

2. What is your understanding of 'global connections'?

		Frequency	Percent	Valid Percent
Valid	Skills that enable us to operate in any context	5	4.8	4.8

2. What is your understanding of 'global connections'?

		Frequency	Percent	Valid Percent
	Communication with people of other cultures, religions, and languages	13	12.5	12.5
	Cultural awareness, language and communication skills, international awareness and networking	72	69.2	69.2
	Global skills are those skills that enable us to communicate in an international context	14	13.5	13.5
	Total	104	100.0	100.0

Most participants (69.2%) said that their understanding of global connections was cultural awareness, language and communication skills, international awareness and networking.

Table 4.25: Developing Global Connections

3. To what extent do you agree with these statements about your class?

I have tried to develop students' skills in making global connections

		Frequency	Percent	Valid Percent
Valid	Not really	30	28.8	28.8
	To a minor extent	38	36.5	36.5
	To a moderate extent	21	20.2	20.2
	To a great extent	9	8.7	8.7
	To a very great extent	6	5.8	5.8
	Total	104	100.0	100.0

Most participants (36.5%) agreed to a minor extent.

Table 4.26: Statistics for Developing Global Connections

Global connections: Statistics for the extent of agreement to the following statements

		I have tried to develop students' skills in making global connections	Most students have learned to make global connections while in my class	I have been able to effectively assess students' skills in making global connections
N	Valid	104	104	104
	Missing	0	0	0
Mean		2.26	2.03	1.93
Median		2.00	2.00	2.00
Mode		2	1	1
Std. Deviation		1.141	1.028	.988
Minimum		1	1	1
Maximum		5	5	5

The coding for participants' understanding of global connections is as follows: 1 = not really, 2 = to a minor extent, 3 = to a moderate extent, 4 = to a great extent, 5 = to a very great extent. The most prevalent global connections statement (based on the mean) was to have tried to develop students' skills in making global connections ($\bar{X}$ = 2,26 ± 1,14) while the least prevalent statement was to have been able to effectively assess students' skills in making global connections ($\bar{X}$ = 1,93 ± 0,99). The most frequently agreed upon global connection statement (based on the mode) was to have tried to develop students' skills in making global connections (mode = 2, which was to a minor extent), while the other statements were less frequent (mode = 1, which was not really).

4.4.1.7 Local connections

The questionnaire defines local connections as: "Local Connections refers to students being able to apply what they have learned to local contexts and community issues."

Table 4.27: Statistics for Teaching Local Connections

Local connections: Statistics for how often have you asked students to do the following?

		Investigate topics or issues that are relevant to their family or community?	Apply what they are learning to local situations, issues or problems?	Talk to one or more members of the community about a class project or activity?	Analyse how different stakeholder groups or community members view an issue?	Respond to a question or task in a way that weighs the concerns of different community members or groups?
N	Valid	104	104	104	104	104
	Missing	0	0	0	0	0
Mean		2.71	2.87	2.38	2.30	2.38
Median		2.00	3.00	2.00	2.00	2.00
Mode		2	2	2	2	1
Std. Deviation		1.220	1.262	1.208	1.190	1.208
Minimum		1	1	1	1	1
Maximum		5	5	5	5	5

The coding for participants' understanding of local connections is as follows: 1 = almost never, 2 = a few times a term, 3 = one to three times per month, 4 = one to three times per week, 5 = almost daily. The most frequent instruction regarding local connections (based on the mean) was to apply what they are learning to local situations, issues or problems ($\bar{X}$ = 2,87 ± 1,26) while the least frequent instruction was to analyse how different stakeholder groups or community members view an issue

($\bar{X}$ = 2,30 ± 1,19). The least frequent instruction regarding local connections (based on the mode) was to respond to a question or task in a way that weighs the concerns of different community members or groups (mode = 1, which is almost never), while all other instructions were slightly more frequent (mode = 2, which was a few times a term).

Table 4.28: Understanding of Local Connections

2. What is your understanding of 'local connections'?

		Frequency	Percent	Valid Percent
Valid	Having family or friends living in different towns	1	1.0	1.0
	Communication with people in different languages	12	11.5	11.5
	Connecting with teachers from other schools	7	6.7	6.7
	Being able to form connections within your area	84	80.8	80.8
	Total	104	100.0	100.0

Most participants (80.8%) said that their understanding of local connections was being able to form connections within your area.

Table 4.29: Develop Local Connections

3. To what extent do you agree with these statements about your class?

I have tried to develop students' skills in making local connections

		Frequency	Percent	Valid Percent
Valid	Not really	19	18.3	18.3
	To a minor extent	35	33.7	33.7
	To a moderate extent	34	32.7	32.7
	To a great extent	12	11.5	11.5
	To a very great extent	4	3.8	3.8
	Total	104	100.0	100.0

Most participants (33.7%) agreed to a minor extent.

Table 4.30: Statistics for Development of Local Connections

Local connections: Statistics for the extent of agreement to the following statements

		I have tried to develop students' skills in making local connections	Most students have learned to make local connections while in my class	I have been able to effectively assess students' skills in making local connections
N	Valid	104	104	104
	Missing	0	0	0
Mean		2.49	2.38	2.27

Local connections: Statistics for the extent of agreement to the following statements

	I have tried to develop students' skills in making local connections	Most students have learned to make local connections while in my class	I have been able to effectively assess students' skills in making local connections
Median	2.00	2.00	2.00
Mode	2	2[a]	2
Std. Deviation	1.043	1.082	1.090
Minimum	1	1	1
Maximum	5	5	5

a. Multiple modes exist. The smallest value is shown.

The coding for participants' understanding of global connections is as follows: 1 = not really, 2 = to a minor extent, 3 = to a moderate extent, 4 = to a great extent, 5 = to a very great extent. The most prevalent local connections statement (based on the mean) was to have tried to develop students' skills in making local connections ($\overline{X}$ = 2,49 ± 1,04) while the least prevalent statement was to have been able to effectively assess students' skills in making local connections ($\overline{X}$ = 2,27 ± 1,09). The most frequently agreed upon local connection statement (based on the mode) was that most students have learned to make local connections while in my class (multiple modes of which 2 was the smallest), the other two statements were slightly less frequently agreed with (mode = 2, which was to a minor extent).

4.4.1.8 Using technology as a tool for learning

The questionnaire defines using technology as a tool for learning as: "Using technology as a tool for learning refers to students being able to manage their learning and produce products using appropriate information and communication technologies."

Table 4.31: Statistics for Using Technology as a Tool

Using technology as a tool for learning: Statistics for how often have you asked students to do the following?

	Use technology or the Internet for self-instruction (e.g., Kahn Academy or other videos, tutorials, self-instructional websites, etc.)?	Select appropriate technology tools or resources for completing a task?	Evaluate the credibility and relevance of online resources?	Use technology to analyse information (e.g., databases, spreadsheets, graphic programmes, etc.)?	Use technology to help them share information (e.g., multi-media presentations using sound or video, presentation software, blogs, podcasts, etc.)?	Use technology to support teamwork or collaboration (e.g., shared workspaces, email exchanges, giving and receiving feedback, etc.)?	Use technology to interact directly with experts or members of local/global communities?	TECH - Use technology to keep track of their work on extended tasks or assignments?
N Valid	104	104	104	104	104	104	104	104
Missing	0	0	0	0	0	0	0	0
Mean	3.38	3.47	3.17	3.45	3.37	3.14	2.77	3.02
Median	3.00	3.00	3.00	4.00	3.00	3.00	3.00	3.00
Mode	3	5	3	5	5	3	1	3
Std. Deviation	1.264	1.246	1.265	1.299	1.359	1.310	1.388	1.421
Minimum	1	1	1	1	1	1	1	1
Maximum	5	5	5	5	5	5	5	5

The coding for participants' understanding of using technology as a tool is as follows: 1 = almost never, 2 = a few times a term, 3 = one to three times per month, 4 = one to three times per week, 5 = almost daily. The most frequent instruction regarding using technology as a tool for learning (based on the mean) was to select appropriate technology tools or resources for completing a task ($\overline{X}$ = 3,47 ± 1,25) while the least frequent instruction was to use technology to interact directly with experts or members of local/ global communities ($\overline{X}$ = 2,77 ± 1,39).

The most frequent instructions regarding using technology as a tool for learning (based on the mode) was to select appropriate technology tools or resources for completing a task, use technology to analyse information, use technology to help share information (mode = 5, which was almost daily), while the lease frequent instruction was to use technology to interact directly with experts or members of local/ global communities (more = 1, which was almost never).

Table 4.32: Understanding of Using Technology as a Tool

2. What is your understanding of using technology as a tool for learning?

		Frequency	Percent	Valid Percent
Valid	ICT can be used for teaching and learning	15	14.4	14.4
	ICT forces a new way of teaching and learning	7	6.7	6.7
	ICT tools are mainly an addition to teaching and learning	14	13.5	13.5
	Technology is a tool that can change the nature of teaching and learning	68	65.4	65.4
	Total	104	100.0	100.0

Most participants (65.4%) said that their understanding of using technology as a tool for learning was that technology is a tool that can change the nature of teaching and learning.

Table 4.33: Developing Using Technology as a Tool

3. To what extent do you agree with these statements about your class?

I have tried to develop students' skills in using technology as a tool for learning

		Frequency	Percent	Valid Percent
Valid	Not really	2	1.9	1.9
	To a minor extent	16	15.4	15.4
	To a moderate extent	27	26.0	26.0
	To a great extent	30	28.8	28.8
	To a very great extent	29	27.9	27.9
	Total	104	100.0	100.0

Most participants (28.8%) agreed to a great extent.

Table 4.34: Statistics for developing Use of Technology as a Tool

Using technology as a tool for learning: Statistics for the extent of agreement to the following statements

		I have tried to develop students' skills in using technology as a tool for learning	Most students have learned to use technology as a tool for learning while in my class	I have been able to effectively assess students' skills in using technology for learning
N	Valid	104	104	104
	Missing	0	0	0
Mean		3.65	3.43	3.28
Median		4.00	3.50	3.00
Mode		4	3	3
Std. Deviation		1.104	1.213	1.333
Minimum		1	1	1
Maximum		5	5	5

The coding for participants' understanding of using technology as a tool is as follows: 1 = not really, 2 = to a minor extent, 3 = to a moderate extent, 4 = to a great extent, 5 = to a very great extent. The coding for participant's understanding of global connections is as follows: 1 = not really, 2 = to a minor extent, 3 = to a moderate extent, 4 = to a great extent, 5 = to a very great extent. The most prevalent technology as a tool for learning statement (based on the mode) was that they have tried to develop students' skills in using technology as a tool for learning (mode = 4, which was to a great extent), the other two statements were less frequently agreed with (mode = 3, which was to a moderate extent).

4.5 INFERENTIAL ANALYSIS

The review of the inferential analysis is presented below. New variables were created by recoding existing variables so that inferential statistics (Chi-square analysis) could determine an association between using ICT and obtaining 21st century skills.

4.5.1 Teaching with ICT

A teaching with ICT variable was created by recoding the question "I have tried to develop students' skills using technology as a tool for learning":

Rarely = not really/to a minor extent/to a moderate extent, Often = great extent/very great extent.

Table 4.35: Teaching with ICT

I have tried to develop student's skills using technology as a tool for learning

		Frequency	Percent	Valid Percent
Valid	Rarely	45	43.3	43.3
	Often	59	56.7	56.7
	Total	104	100.0	100.0

Most participants (56.7%) often tried to develop students' skills using technology as a tool for learning.

4.5.2 21st century skills

A variable was created for each 21st century skill by recoding the question "Most students have learned ... while in my class":

Few students have learned the skill = not really/to a minor extent/to a moderate extent, most students have learned the skill = to a great extent/to a very great extent.

Table 4.36: Most Students have learned Critical Thinking Skills

Most students have learned critical thinking skills while in my class

		Frequency	Percent	Valid Percent
Valid	Few students have learned the skill	81	77.9	77.9
	Many students have learned the skill	23	22.1	22.1
	Total	104	100.0	100.0

Some participants (22.1%) had many students who have learned the skill of critical thinking while in their class.

Table 4.37: Most students have learned Collaboration Skills

Most students have learned collaboration skills while in my class

		Frequency	Percent	Valid Percent
Valid	Few students have learned the skill	89	85.6	85.6
	Many students have learned the skill	15	14.4	14.4
	Total	104	100.0	100.0

Some participants (14.4%) had many students who have learned the skill of collaboration while in their class.

Table 4.38: Most students have learned Communication Skills

Most students have learned communication skills while in my class

		Frequency	Percent	Valid Percent
Valid	Few students have learned the skill	71	68.3	68.3
	Many students have learned the skill	33	31.7	31.7
	Total	104	100.0	100.0

Some participants (31.7%) had many students who have learned the skill of communication while in their class.

Table 4.39: Most students have learned Creativity and Innovation Skills

Most students have learned creativity and innovation skills while in my class

		Frequency	Percent	Valid Percent
Valid	Few students have learned the skill	82	78.8	78.8
	Many students have learned the skill	22	21.2	21.2
	Total	104	100.0	100.0

Some participants (21.2%) had many students who have learned the skill of creativity and innovation while in their class.

Table 4.40: Most students have learned Self-direction Skills

Most students have learned self-direction skills while in my class

		Frequency	Percent	Valid Percent
Valid	Few students have learned the skill	82	78.8	78.8
	Many students have learned the skill	22	21.2	21.2
	Total	104	100.0	100.0

Some participants (21.2%) had many students who have learned the skill of self-direction while in their class.

Table 4.41: Most students have learned to make Global Connections

Most students have learned to make global connections while in my class

		Frequency	Percent	Valid Percent
Valid	Few students have learned the skill	94	90.4	90.4
	Many students have learned the skill	10	9.6	9.6
	Total	104	100.0	100.0

Few participants (9.6%) had students who have learned to make global connections while in their class.

Table 4.42: Most students have learned to make Local Connections

Most students have learned to make local connections while in my class

		Frequency	Percent	Valid Percent
Valid	Few students have learned the skill	88	84.6	84.6
	Many students have learned the skill	16	15.4	15.4
	Total	104	100.0	100.0

Some participants (15.4%) had many students who have learned to make local connections while in their class.

4.5.3 Obtaining 21st century skills

An additional variable was created for the concept of obtaining 21st century skills:

Few 21st century skills learned = Many students have learned the skill for 0-3 of the 7 skills. Most 21st century skills learned = Many students have learned the skill for 4-7 of the 7 skills.

Table 4.43: Obtaining 21st Century Skills

Obtaining 21st century skills

		Frequency	Percent	Valid Percent
Valid	Few 21st century skills learned	90	86.5	86.5
	Most 21st century skills learned	14	13.5	13.5
	Total	104	100.0	100.0

Some participants (13.5%) had significant students who had obtained 4-7 of the 21st century skills.

4.5.4 Chi-Square Analysis

The chi-square analysis aims to test the association between teaching with ICT tools and obtaining 21st century skills.

Table 4.44: Obtaining 21st Century Skills Cross-tabulation

I have tried to develop student's skills using technology as a tool for learning * Obtaining 21st century skills Crosstabulation

			Obtaining 21st century skills		
			Few 21st century skills learned	Most 21st century skills learned	Total
I have tried to develop students' skills using technology as a tool for learning	Rarely	Count	44	1	45
		Expected Count	38.9	6.1	45.0
		% within I have tried to develop student's skills using technology as a tool for learning	97.8%	2.2%	100.0%
		% within Obtaining 21st century skills	48.9%	7.1%	43.3%
		% of Total	42.3%	1.0%	43.3%
	Often	Count	46	13	59
		Expected Count	51.1	7.9	59.0
		% within I have tried to develop students' skills using technology as a tool for learning	78.0%	22.0%	100.0%
		% within Obtaining 21st century skills	51.1%	92.9%	56.7%
		% of Total	44.2%	12.5%	56.7%
Total		Count	90	14	104
		Expected Count	90.0	14.0	104.0
		% within I have tried to develop students' skills using technology as a tool for learning	86.5%	13.5%	100.0%
		% within Obtaining 21st century skills	100.0%	100.0%	100.0%
		% of Total	86.5%	13.5%	100.0%

For the results of a chi-square test of association to be valid, all cells need to have expected cell counts greater than five. From the rows highlighted in the table above it can be seen that all expected count frequencies were more than five. This assumption has therefore not been violated and we can interpret the result of the chi-square test of association.

Table 4.45: Chi-square Tests

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8.601[a]	1	.003		
Continuity Correction[b]	6.985	1	.008		
Likelihood Ratio	10.357	1	.001		
Fisher's Exact Test				.003	.002
Linear-by-Linear Association	8.519	1	.004		
N of Valid Cases	104				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.06.

b. Computed only for a 2x2 table

From the row highlighted in the table above it can be seen that there was a statistically significant association ($p < 0.05$) between teaching with ICT tools and obtaining 21st century skills, $\chi2(1) = 8.601$, $p = 0.003$. From the cells highlighted in the table below it can be seen that 2.2% of those who rarely tried to develop students' skills using technology as a tool for learning scored a 97.8% success rate for 21st century skills, while 22.0% of those who often tried to develop student's skills using technology as a tool for learning scored a 78% success rate for 21st century skills.

Table 4.46: Cross-tabulation: Obtaining 21st Century Skills

I have tried to develop student's skills using technology as a tool for learning * Obtaining 21st century skills Crosstabulation

			Obtaining 21st century skills		Total
			Few 21st century skills learned	Most 21st century skills learned	
I have tried to develop student's skills using technology as a tool for learning	Rarely	Count	44	1	45
		Expected Count	38.9	6.1	45.0
		% within I have tried to develop student's skills using technology as a tool for learning	97.8%	2.2%	100.0%
		% within Obtaining 21st century skills	48.9%	7.1%	43.3%
		% of Total	42.3%	1.0%	43.3%
	Often	Count	46	13	59
		Expected Count	51.1	7.9	59.0
		% within I have tried to develop student's skills using technology as a tool for learning	78.0%	22.0%	100.0%
		% within Obtaining 21st century skills	51.1%	92.9%	56.7%
		% of Total	44.2%	12.5%	56.7%

I have tried to develop student's skills using technology as a tool for learning * Obtaining 21st century skills Crosstabulation

		Obtaining 21st century skills		
		Few 21st century skills learned	Most 21st century skills learned	Total
Total	Count	90	14	104
	Expected Count	90.0	14.0	104.0
	% within I have tried to develop student's skills using technology as a tool for learning	86.5%	13.5%	100.0%
	% within Obtaining 21st century skills	100.0%	100.0%	100.0%
	% of Total	86.5%	13.5%	100.0%

From the effect size measures in the table below (i.e. the practical size of the effect) it can be seen that the effect size was small (Cohen, Manion, & Morrison, 2007), Phi=0.288.

Table 4.47: Symmetric Measures

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.288	.003
	Cramer's V	.288	.003
N of Valid Cases		104	

4.6 SUMMARY

A chi-square test for association was conducted between teaching with ICT tools and obtaining 21st century skills. All of the expected cell frequencies were greater than five, therefore the assumption was not violated.

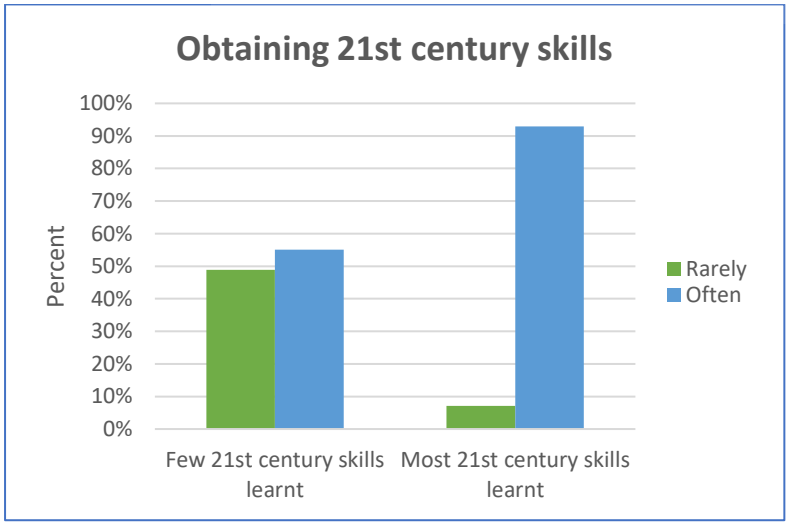

Figure 4.5: Obtaining 21st century skills

There was a statistically significant association between teaching with ICT and obtaining 21st century skills, $\chi 2(1) = 8.601$, $p = 0.003$. It was determined that 2.2% of those who rarely tried to develop student's skills using technology as a tool for learning scored the highest for 21st century skills, while 22.0% of those who often tried to develop student's skills using technology as a tool for learning scored the second highest for 21st century skills. Although the result was statistically significant, the effect size showed a weak association (Cohen, Manion, & Morrison, 2007), as measured by the Phi measure of effect size, $\varphi = 0.288$, $p = 0.003$.

CHAPTER 5 – FINDINGS AND RECOMMENDATIONS

5.1 INTRODUCTION

Chapter 4 presented the data that was collected, after which it was analysed and discussed. This chapter discusses the main and general findings, followed by the recommendations and concludes with limitations to the study.

5.2 DISCUSSION OF MAIN FINDINGS

South African students are from diverse backgrounds, languages and races. There is a division of wealth and this is visible in schools. There are challenges such as shortages of resources, challenges with technological access, inadequate technical support, resistance to change, and no support from school management teams. This is worrying and these inequalities should be addressed before integration of ICT and teaching of 21st century skills to ensure the implementation of policy can be successful. The policymakers need to attend to the digital divide between the different parts of the South African population (Department of Telecommunications and Postal Services, 2016). Research found that there was a gap between government expectations and the practices in the classroom (Padayachee, 2017). The empirical evidence shows that 21st century skills should be integrated in the teaching of subjects, but this is not the case. Vandeyar (2015) states that there are many challenges involved in ICT integration in schools as seen in paragraph 2.6.

The aim of this study was to establish to what extent teachers integrate ICT tools into their classrooms to enhance 21st century skills. To answer this question, three sub-questions were formulated. Firstly, literature was consulted to establish if teachers are aware of 21st century skills. The empirical evidence endeavoured to determine if teachers know what 21st century skills are by requesting them to select the definition they most agreed with about these 21st century skills. Secondly, teachers' views on the integration of ICT to enhance 21st century skills in schools were investigated, making use of a quantitative research design approach. Lastly, the research

endeavoured to determine if there is a relationship between teaching with ICT tools and obtaining 21st century skills.

The positivist paradigm (paragraph 3.3.1) was found to be appropriate for this study as the observations rely specifically on statistical evidence, to reveal how society operates (Scotland, 2012). The results of this study were gathered online and were seen to be objective since the measuring instrument, a questionnaire, did not interfere with the views of teachers.

Teachers were required to complete a questionnaire that investigated their perceptions of using ICT and of teaching 21st century skills. The rest of the section will discuss the findings of the sub-questions that were presented in chapter 1 and general findings obtained during the research.

5.2.1 How aware are teachers of 21st century skills?

The angle of the Zone of Proximal Development chosen in this study is that Vygotsky (1978) assumes that a student needs assistance to learn. Teachers and students are active agents in the learning process. A teacher is needed and this teacher can select certain tools to enhance the learning process. Tools take the role of mediation of human reactions and their interacting in the world. These tools could be technological. Tools provide expanded human actions of achieving the goals of a lesson. This theory treats these tools as a way of addressing needs and assisting with the achievement of matching goals. This creates an uncommon approach, where there are many elements that emphasise the aim of using the computer as an instrument surrounded by human activity, both mentally and physically (Venenikina, 2010). This tool is then used to acquire certain skills through the guidance of the teacher. Learning through ICT is embedded in everyday use by students but must be accompanied by a willing teacher.

Sustainable Development Goal four (United Nations Development Programme (UNDP), 2016) called for skills to enhance global social responsibility and sustainable development. Yildrim (2007) conducted a study that showed that many teachers use ICT as their main resource of disseminating the necessary subject knowledge and they do not therefore specifically plan, manage and integrate the global skills for sustainable development as called for by Sustainable Development Goal four (United Nations Development Programme (UNDP), 2016). It was evident from the results

obtained from this survey that 21st century skills are not taught explicitly in classrooms every day; however, these skills may be developed through practice and may be included into the teaching of subjects.

Teachers' and schools' understanding of technology is crucial to its integration. Technology adoption is an advanced and continuous process because teachers need to recognise its advantages and believe that it can be used to improve teaching and learning (Buabeng-Andoh, 2012). Teachers need to use it, and then only will they form a favourable attitude to accept it. Using it more often to develop activities will improve their confidence with the use of technology, seeing the positive effects of their decision and choosing to integrate it successfully in their classrooms, which would lead to success.

There is a strong contrast between ideals put forward by policymakers in South Africa, and the reality seen in schools. Many challenges are faced by teachers and students in the integration of ICT in classrooms. There are two sides to the policy; the policymakers that are optimistic that the White Paper on e-Education (Department of Basic Education, 2004) will transform education and force technologies into the classroom, and on the other hand, policymakers see that many challenges need to be overcome, including professional development of teachers, infrastructure of ICT tools, support from school managers and overcoming the lack of technological integration in schools, which are some of the realities regarding education in South Africa (Department of Telecommunications and Postal Services, 2017). The critical outcomes as stated by the National Curriculum Statement (2003) in paragraph 2.7 aim to prepare students for the 21st century by providing them with the necessary skills; however, the reality is different, since traditional teaching methods are still used (see paragraph 1.6.3).

This study focused on teachers' own opinions of the teaching of 21st century skills in their classrooms and is limited to their own perceptions. Only 9.6% of teachers stated that they have attempted to develop critical thinking skills to a very great extent (see *Table 4.5: Developing Critical Thinking Skills*), 3.8% have attempted to develop collaboration skills to a very great extent (see *Table 4.9: Develop Collaboration Skills*), 12.5% have attempted to develop communication skills to a very great extent (see *Table 4.13: Developing Communication Skills*), 5.8% have attempted to develop creativity and innovation skills to a very great extent (see *Table 4.17: Developing*

Creativity and Innovation Skills), 12.5% have attempted to develop self-direction skills to a very great extent (see *Table 4.21: Developing Self-direction Skills*). This shows that the White Paper policy implemented to integrate ICT in schools (Department of Basic Education, 2004) and the National Curriculum Statements (Department of Basic Education, 2003) to integrate the teaching of 21st century skills in subjects have not been fully executed in classrooms yet. This points to the fact that policymakers were optimistic in policies forcing the change, but reality proves different. Technology does not drive teaching. Vandeyar (2015) believes that the enforcement of the policies is lacking. The challenge lies in how teachers use technology and how they effectively integrate technology in the classroom.

The mode indicates the most frequent selection of an answer. It may be more revealing than the mean or median, because there is normally no 'equality' between options – as the difference between 'not really' and 'to a minor extent' may not be the same as between 'to a minor extent' and 'to a moderate extent' . This is very subjective. The mode of critical thinking skills scored mostly 2, which refers to a few times a term (see *Table 4.3: Statistics for Teaching Critical Thinking Skills*), indicating that most teachers teach critical thinking skills very rarely. The mode of collaboration skills scored between 1 and 2, which refers to almost never and a few times a term (see *Table 4.7: Statistics for Teaching Collaboration Skills*), indicating that most teachers teach collaboration skills even less than critical thing skills. The mode of communication skills also scored between 1 and 2, which refers to almost never and a few times a term (see *Table 4.11 Statistics for Teaching Communication Skills*), indicating that most teachers teach communication skills very rarely. The mode of creativity and innovation skills is consistent on a few times a term, with a score of 2, (see *Table 4.15: Statistics for teaching Creativity and Innovation Skills*), which shows that most teachers teach creativity and innovation skills a few times a term. The development of self-direction skills is slightly higher showing a mode of between 2 and 3, which varies between a few times a term and a few times per month (see *Table 4.15: Statistics for teaching Creativity and Innovation Skills*). Even though the National Curriculum Statements (Department of Basic Education, 2003) aim to integrate the teaching of 21st century skills in all subjects, this is clearly not the case, since the data shows that most teachers in the sampled subjects only teach these skills a few times a term. The traditional culture of teaching and learning is still mostly followed and this is

characterised by a lack of teaching of 21st century skills. The White Paper (Department of Basic Education, 2004) hoped to transform traditional teaching and learning and as seen from the data obtained, this is not the case. The optimistic view by policymakers that ICT will transform teaching was not seen to be successful during this study. South Africa's Education Department realises the importance of STEM education in schools and therefore forces the integration of the teaching of 21st century skills in all subjects as seen in the National Curriculum Statement (Department of Basic Education, 2003).

The majority (89.4%) of teachers agreed with the definition of critical thinking skills (see *Table 4.4: Understanding of Critical Thinking Skills*), while 43.3% of teachers agreed with the definition of collaboration skills (see *Table 4.8: Understanding of Collaboration Skills*). On communication, 46.2% of teachers agreed with this definition (see *Table 4.12: Understanding of Communication Skills*). Moreover, 59.6% of teachers agreed with the definition of creativity and innovation skills (see Table 4.16: Understanding of Creativity and Innovation Skills), while 55.8% of teachers agreed with the definition of self-direction skills (see *Table 4.20: Understanding of Self-direction Skills*).

It is pleasing to note that 69.2% of teachers agreed with the definition of global connections (see *Table 4.24: Understanding of Global Connections*); moreover, 80.8% of teachers agreed with the definition of local connections (see *Table 4.28: Understanding of Local Connections*). Most teachers (64.4%) (see *Table 4.32: Understanding of Using Technology as a Tool*) agreed with Darling-Hammond, Flook, Cook-Harvey, Barron & Osher (2020) that technology "is a tool that can change the nature of learning." Technology provides the opportunity for exploration. However, for technology to be implemented efficiently, the use of technology must be seen as vital to both teaching and learning (Darling-Hammond, Flook, Cook-Harvey, Barron, & Osher, 2020). Teachers need to see the affordances of teaching with ICT before they will attempt to integrate it in their classrooms. As Hammond (2010) states in paragraph 2.3, affordance should be perceived first before these can be realised and implemented.

The aim of providing definitions verified if teachers were aware of the 21st century skills. This proved that most teachers understood what the identified 21st century skills required. Teachers are aware of the 21st century skills, but still only teach these skills a few times a term or one to three times per month. Teachers are aware of 21st century

skills as seen above; however, only 22.1% of students acquired critical thinking skills (see *Table 4.36: Most Students have learned Critical Thinking Skills*), 14.4% of students acquired collaboration skills (see), 31.7% of students acquired communication skills (see *Table 4.38: Most students have learned Communication Skills*), 21.2% of students acquired creativity and innovation skills (see *Table 4.39: Most students have learned Creativity and Innovation Skills*), 21.2% of students acquired self-direction skills (see *Table 4.40: Most students have learned Self-direction Skills*), 9.6% of students were able to make global connections (see *Table 4.41: Most students have learned to make Global Connections*) and 15.4% were able to make local connections (see *Table 4.42: Most students have learned to make Local Connections*).

These percentages are considerably low considering that ICT integration in schools and integration of 21st century skills in subjects have been implemented since 2003. ICT tools have been provided to schools in South Africa as seen in the Action Plan (Department of Basic Education, 2015). Nevertheless, access to technology did not change teaching practices significantly as proven by Karasavvidis (2009). The review of teacher perceptions concerning ICT-based integration may provide insight into what the teacher priorities are and this will determine the future success of integration of ICT in teaching and learning and not stop at merely knowing what the skill entails.

Evidence has shown that teachers are aware of 21st century skills, know how to identify them, and are able to define them; however, this does not mean that they teach 21st century skills in their classrooms. Policymakers had an optimistic view that by implementing policy and including the teaching of 21st century skills in all subjects, the teaching of important global skills would be automatically taught in classrooms. The importance needs to be seen by teachers before they implement the teaching of 21st century skills.

5.2.2 How often do teachers perceive themselves integrating 21st century skills in their teaching?

ICT tools offer the opportunity to teachers to make their teaching more connected to the real-world by using multi-media (De Sousa, 2017). Amin (2013) argues that embracing ICT tools in classrooms has a positive impact on the teaching and learning environment. Pineida (2011) agrees in paragraph 2.3 that ICT has many affordances

such as the ability to motivate and engage students, and ensure that students experience real-life situations in their school experiences, create global citizens, and strengthen teaching.

The South African e-Education White Paper aimed to transform teaching and learning (Department of Basic Education, 2004). The goal was that performance should improve, functioning should improve, and ultimately teaching and learning will improve. However, reality is far from ideology. South African policymakers expected that the use of ICT in schools would change the way teachers teach, what skills are obtained and new teaching methods would happen automatically. What is desired and what is real, however, are different. The policy attempted to define reality and change behaviour. Koh (2015) believes that the key factor for the successful integration of technological tools into learning and teaching was whether educators had sufficient technology training. Technological support is needed on a continuous basis.

Again, as stated by Voogt and Roblin (2012), teacher's attitudes are a determining factor. Pedagogy should drive technology. If teachers believe technology to be favourable, they will more likely embrace it. The data showed that only 27.9% of teachers tried to develop students' skills in using technology as a tool for learning (see *Table 4.33: Developing Using Technology as a Tool*). The challenge is that teachers need to distinguish between promoting ICT skills during teaching as seen in paragraph 2.3.1 and using ICT in the teaching and learning process (Amin, 2013) as seen in paragraph 2.3.2. If teachers lack the ability to see the ample possibilities ICT can provide, such as motivation, real-life simulation and strengthening teaching and learning, they may not feel the need to adapt to the changes enforced by the South African Department of Education through policy. Vandeyar (2015) believes that teachers misinterpret the policy and merely provide ICT to students without embracing the possibility that it can transform teaching and learning.

Mishra and Koehler (2006, p. 1033) believe that "Merely knowing how to use technology is not the same as knowing how to teach with it." TPACK ("Technological, Pedagogical, Content Knowledge") created by Mishra and Koehler (2006) emphasises the notion that what teachers know about efficient teaching, their subject knowledge and teaching technology must be used together for them to successfully support student learning. Planning systemic curriculum implementation will provide a better chance to successfully implement 21st century skills in education (Kozma, 2011).

TPACK accepts that the teacher should have a balance between technology, pedagogy and content knowledge.

It is clear from the evidence that 56.7% of teachers often use technology as a tool for teaching and learning (see *Table 4.35: Teaching with ICT*), but do not use it to teach 21st century skills effectively since 13.5% stated that most 21st century skills were learned (see *Table 4.43: Obtaining 21st Century Skills*). Teachers must have the choice of the most appropriate technological tools to teach content in the most appropriate way (Liviani, 2020). Although ICT tools allow the teaching of 21st century skills, it is clear from the data that teachers do not teach these skills. Teachers have a good understanding of 21st century skills, yet they do not develop these in the classroom. STEM subjects are not the only ones that contain 21st century skills since curriculum has been refined in 2004 to include the teaching of 21st century skills in all subjects. The intention is to force the teaching of 21st century skills in all classrooms, with or without the use of ICT.

Almost a third (31.7%) of teachers indicated that they had up to five years' experience and 34.6% had 6 to 10 years' experience using ICT in their classrooms (see *Table 4.2: Demographics of Respondents*). However, even though the majority has more than 5 years of experience teaching with ICT, most teachers revealed that they teach the skills a few times a term or one to three times per month (paragraph 4.4). Policies are put in place to transform education by integrating ICT into learning and teaching (Department of Basic Education, 2004) but reality may show a different scenario. The United Nations Education, Science and Cultural Organisation – UNESCO Institute for Information Technologies in Education launched the "Guidelines on Adaptation of the UNESCO's ICT Competency Framework for Teachers" (Midoro, 2013). Despite the presence of this framework, the challenges surrounding the embracing of current ICT models into the classrooms are persistent. Teachers may consider 21st century skills as disruptive and an addition to their already full curriculum and may perceive using ICT as distracting them from their subject-related goals and objectives (Onyema & Daniil, 2017). Fears from teachers include the limited amount of time and how the teaching of 21st century skills will be distributed across subjects (Buabeng-Andoh, 2012). The OECD's ICT Framework (2019) also accepts that the availability, accessibility and quality of ICT resources determine teachers' and students' experiences with ICT tools in the classroom.

Teachers develop their own opinions about the importance of ICT as a teaching mechanism, the worth of ICT in learning outcomes and their own self-confidence and competence (Mynbayeva, Sadvakassova, & Akshalova, 2017). Teachers are forced to accept and integrate ICT into their class activities, but their willingness to adopt ICT into their classroom will determine the success of the technology and not only the fact that it is available in their classrooms (Bingimlas, 2009). It is clear from the data obtained that 65.4% (see *Table 4.32: Understanding of Using Technology as a Tool*) of teachers believe that technology is a tool that can change the nature of teaching and learning, but only 27.9% try to develop the students' skills in using technology as a tool (*see Table 4.33: Developing Using Technology as a Tool*).

Buabeng-Andoh (2012) believes that if teachers have the opinion that technology may not fulfil their or their students' needs, they may lack the motivation to integrate this into their teaching and learning. Teacher viewpoints are important for successful integration of ICT. Data shows that 13.5 % of teachers successfully used technology to teach 21st century skills (see *Table 4.46: Cross-tabulation: Obtaining 21st Century Skills*) while 86.5% of teachers claim that their students acquired a few 21st century skills through the integration of ICT in their classrooms.

According to Amin (2013) three conditions are needed for teachers to introduce ICT and technology into their classrooms: they should trust the effectiveness of using technology, they must believe that using technology will not disturb teachers, and finally they have to believe that they can manage the technology.

Even though research suggests that ICT can help students to learn more effectively and teachers to teach more efficiently, ICT will not make a difference by merely being used (U.S. Department of Education, 2017). It is clear from the data that although ICT tools afford the development of 21st century skills, this did not happen as only 13.5% of students obtained 21st century skills (see *Table 4.43: Obtaining 21st Century Skills*). All teachers need to enhance their own skills to deliver the new curriculum. The National Policy Framework on Teacher Education should be implemented with stronger force (Department of Basic Education, 2006). Teachers need to be part of a competent community to provide high quality education, high levels of performance with high levels of assessment. This policy states that teachers are the drivers of quality education and teaching of 21st century skills.

Several policies implemented in South Africa to ensure that ICT tools are used to teach 21st century skills did not prove successful since from this research it is evident that teaching is still in traditional mode. Students are not taught to solve problems critically and creatively and are encouraged more to memorise the content. Even though assessment aims to change this by enforcing different cognitive levels, the culture has not changed yet. Teachers are as much embedded in this culture as students and schools in general. Even though teachers may acknowledge the value of ICT and the importance of 21st century skills, various practices, such as assessments structured by the teacher, rigid school timetabling, overcrowded classes, prevent them from developing the needed global skills, values and attitudes (see paragraph 2.4). As much as there is a belief that the perceptions of the teachers may have an influence on the successful integration of ICT and the teaching of 21st century skills, the structural and systemic contexts within which they operate do not provide the necessary freedom to experiment with the successful teaching of 21st century skills and finally delivering lifelong students to the global society (Department of Telecommunications and Postal Services, 2017). Structural and systemic contexts are much harder to change with simple implementation of policy.

5.2.3 What is the relationship between teaching with ICT and obtaining 21st century skills?

The 2T2C model includes the four important pillars needed to integrate ICT into teaching 21st century skills; thinking, technology, communication and confidence (Warner & Kaur, 2017). An obstacle for the use of ICT in teaching and learning is confidence. Many teachers (56.7%) believe that they tried to develop students' global skills using ICT as an instrument for learning (see *Table 4.35: Teaching with ICT*). It could be that they believe that because technology is used, 21st century skills are automatically obtained, thus referring to technological determinism. Technological determinism accepts that technology brings about change without any input from the human factor (Dusek, 2006). The empirical evidence shows that technology is not adequately used to promote 21st century skills (see *Table 4.43: Obtaining 21st Century Skills*). Few 21st century skills are taught. This may point to the persistence of a traditional culture of teaching and learning which has not been changed through technology.

Amin (2013) states as seen in paragraph 2.3.1, that the use of ICT in the education system is divided into: ICT *for* Education and ICT *in* Education. ICT for education states that ICT skills are obtained during teaching and learning. The mere use of ICT should, according to the South African White Paper (2004), improve higher order thinking skills, such as creativity, problem-solving and reasoning. This is a belief that technology will bring about the required change as stated by technological determinism (see paragraph 1.6.3). The policies forced by the South African Department of Education (2004) ignore teacher difficulties and could be negatively influenced by teacher attitudes. Pineida (2011) agrees with Anderson (2008) that the use of ICT in the classroom would not ensure learning and performance improvement. Technology as an instrument can change the character of learning, however (Darling-Hammond, Flook, Cook-Harvey, Barron, & Osher, 2020). Teachers believe that technology can be used to positively influence learning (see *Table 4.32: Understanding of Using Technology as a Tool*). Effective learning can be achieved with the assistance and provision of ICT resources and tools (Meenakshi, 2013).

The results of the survey indicate that most teachers perceived using technology for learning and teaching as an instrument which can change the nature of teaching and learning (paragraph 4.5.1). Even though teachers understand that technology can force change, they are not inclined to incorporate it in their daily teaching since the mean of between 2.77 and 3.45 shows that they choose to integrate it one to three times per month (see *Table 4.31: Statistics for Using Technology as a Tool*).

From the chi-square analysis (paragraph 4.5.4), 22% of teachers state that they have often tried to advance students' skills using technology as an instrument for learning and 2.2% rarely tried to develop student's skills using technology as a tool for learning; nevertheless both groups obtained most 21st century skills. It is clear that some 21st century skills are acquired by students, but very rarely (2.2%) all 21st century skills as seen in the graph below.

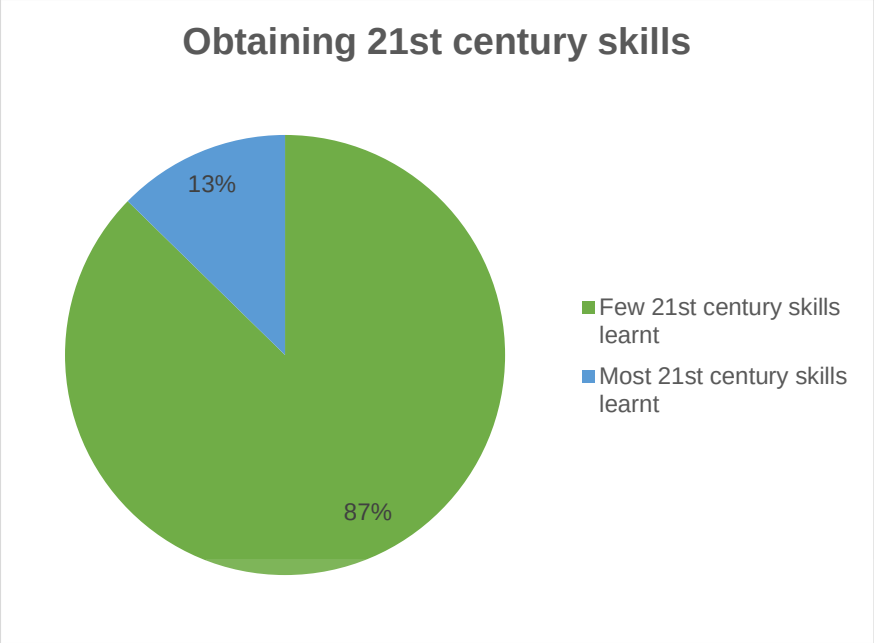

Figure 5.1: Teachers attempting to teach 21st century skills

It is clear from the data provided that teachers rarely try to develop 21st century skills (see *Table 4.46: Cross-tabulation: Obtaining 21st Century Skills*), even though 56.7% (see *Table 4.35: Teaching with ICT*) use technology during teaching. Literature has shown that teachers' attitudes and opinions towards the acquirement of technological skills will influence their way of adopting technology and believing in the usefulness of technology and then integrating it into teaching (Huang & Liaw, 2005). If teachers' attitudes are positive towards the use of technology, even for planning and administration, then they will easily see the affordances of adopting ICT in the classroom and integrating ICT into teaching and learning (paragraph 2.3). Attitudes are dependent on their computer experiences and this in turn could relate positively or negatively to their computer attitudes (Buabeng-Andoh, 2012). When teachers are interested in professional development, they will believe that ICT is a useful instrument to improve their pedagogic practices.

The idea that access to technology will change how students learn and how teachers teach is one that policymakers in South Africa build their policies on. This change is expected to happen automatically, but it brings new challenges. There is no guarantee that changing schools to become digital will provide a suitable learning experience for every student. The focus is on providing technology as a teaching tool in the classroom to be used to change the teaching, learning and assessment environment. The current situation is that assessments and examinations drive the South African educational

system. A more holistic assessment approach should be adopted, as Minister Angie Motshekga advised at the DBE Assessment Roundtable (Department of Basic Education, 2016). Assessment of 21st century skills in classrooms is rare. Students may be taught to use technology as a tool, but teachers do not have standards for assessing 21st century skills. Teachers do not gather evidence about assessing 21st century skills. Mostly, teachers are left on their own to decide how to integrate technology into the curriculum or classroom activities. A much more comprehensive and intensive process is needed including curriculum, forms of assessment, teacher training, support systems, etcetera. The problem with how TPACK is understood is that it is dependent on the focus on the teacher. The problem may not lie with the teacher, policies are developed and implemented and content, pacing and assessment may not allow for successful integration of technology and thus effecting positive learning experiences. Technology should be integrated into an existing culture of teaching and learning for successful implementation (see 21st Century Skills in chapter 2).

5.3 RECOMMENDATIONS

Educators must teach in a revolutionary way. Combining 21st century skills into their classrooms is an increasingly important characteristic of curriculum writing, development and implementation. Integrating technological skills and computer literacy is an ever-evolving opportunity within a competitive curriculum and learning environment. These skills are "more than just introducing students to particular technologies and the ability to use them, but rather highlighting the importance of transferring these skills to relevant real-world applications" (Prensky, 2010, p. 21).

With reference to the findings of the research, the following recommendations are made:

- Educational organisations need to strengthen the link between content knowledge, design thinking, and 21st century competencies. This will ensure that teachers teach the appropriate content, thinking and competencies needed to succeed as global citizens (Koh, Chai, Wong, & Hong, 2015).
- The South African Department of Education believes that teacher interventions may be necessary to achieve all the aims set by the White Paper (Department of Basic Education, 2004). These affordances are achievable, not by only providing

ICT tools to schools, but also by providing the necessary goals that the use of ICT should achieve. Efficient combinations of ICT in the teaching and learning practices will require changes in the national curriculum and systemic challenges should be addressed by the Department of Basic Education. The Action Plan (Department of Basic Education, 2015) outlines that the focus should be on quality teaching and learning with the integration of ICT. Learning outcomes should be achieved.

- Schools should combine 21st century skills, which include critical thinking, problem-solving, collaboration and communication skills, into the teaching of all subjects. The Department of Basic Education aimed with the National Curriculum Statement (Department of Basic Education, 2003), to incorporate 21st century skills (see 21st century skills in chapter 2) into all subjects. However the evidence of this study shows that 21st century skills are not often taught in the subjects selected for this study (see *Table 4.43: Obtaining 21st Century Skills*). Binkley et al. (2009) suggest, as seen in paragraph 2.3, that curricula should be designed and re-designed to reflect successful teaching and learning of 21st century skills.
- The literature states that for successful implementation of the teaching of 21st century skills, Voogt et al. (2012) suggest that one of following three approaches can be used to integrate the teaching of 21st century skills in schools (see paragraph 2.3):

  a) 21st century skills may be included into the existing curriculum as innovative subjects or as additional areas within existing subjects;
  b) 21st century skills can be integrated to overlap curriculum skills that support the existing subjects in the curriculum and emphasise the achievement of broader important competences; or
  c) 21st century skills can be introduced as a new curriculum where out-dated structures are transformed.

  Saavedra and Opfer (2012) argue that students do not develop these competencies and knowledge unless they are specifically taught. Including it in subjects may not prove to be effective.

- Sharing their experiences with other teachers is a successful way to encourage new teaching pedagogies and thus the successful integration and adoption of technology in classrooms (Amin, 2013). Professional teacher training and

obtaining of skills is central to successful integration of technology in schools (OECD, 2015).

- Reconsidering pedagogy for the 21st century is as important as recognising the new competencies that today's students need to acquire. The need for a new knowledge model cannot be excluded from the equitable distribution of knowledge. TPACK states that knowledge of pedagogy, technology and content are necessary for successful implementation of ICT into teaching and learning. It may be necessary to rethink pedagogy (see paragraph 2.3) to include teaching of 21st century skills. Pedagogical changes need to (Leadbeater & Wong, 2010):
  - Reintroduce the focus on quality;
  - Promote involvement and sharing;
  - Customise learning;
  - Emphasise project-based learning;
  - Boost partnerships and communication;
  - Involve and inspire students;
  - Nurture creativity and innovation;
  - Utilise new learning instruments;
  - Design current and real-world problems;
  - Instil metacognitive skills;
  - Develop the most appropriate connections for learning;
  - Surround every student with technology;
  - Focus on learner-centred styles;
  - Promote learning anytime and anywhere;
  - Persuade students to be lifelong students;
  - Measure deeper understanding and expertise; and
  - Redefine teacher roles and functions.

Integration of technology into teaching and learning holds great importance so that students can learn the necessary 21st century skills to be able to compete globally. The Department of Basic Education in South Africa (2003) attempts to underpin the teaching of 21st century skills in all subjects. If implemented successfully, 21st century skills can be integrated into all subjects, even without the use of ICT. However, ICT can change the way these 21st century skills are taught and may impact positively on teaching and learning. Continued support and assistance are needed from educational

departments, school management teams and districts to ensure that these skills are integrated into subjects. Technology must be integrated within the culture of teaching and learning and may contribute to a changed culture, but it cannot bring about the change by itself.

5.4 SUGGESTIONS FOR FURTHER STUDY

The purpose of this research was to determine if teachers integrate 21st century skills into their teaching. The study proved that there is little integration into teaching even though the study proved that teachers use ICT tools. Several recommendations were made for successful integration of 21st century skills using ICT. Further research can be conducted to determine which methods recommended would prove successful for effective integration of 21st century skills into subjects. Future research could focus on whether subjects contain 21st century skills in their syllabi and if 21st century skills are in fact taught, or how they are taught, in all other subjects. This study was limited to the perceptions of teachers and could be extended to the experience of teachers in using of ICT tools and their views of the culture of teaching and learning.

5.5 LIMITATIONS OF THE STUDY

The limitations of the study included the fact that the study was not generalised because the study population was specific to three districts in Gauteng. The COVID-19 lockdown restrictions limited social interaction between the researcher and participants. Online survey research has certain limitations, since guidance cannot be provided to participants and it is not possible to verify that the person that was intended to complete the questionnaire, in fact, is the one who did.

A limited number of subjects (Computer Applications Technology, Information Technology, Mathematics, Mathematical Literacy) were chosen for this study, which may influence the overall view of the teaching of 21st century skills in all other subjects. The results only reflect the views of the teachers of the selected subjects.

5.6 CONCLUDING REMARKS

Research shows that most teachers use technology to enhance traditional practices rather than transforming them to include teaching of 21st century skills (Karasavvidis, 2009). Although teachers use ICT as enforced by policy, few use it to develop 21st century skills. Research also showed that teachers have a good understanding of 21st

century skills; however, they do not develop these in the classroom. ICT may have many affordances, but these are not recognised by teachers and ICT tools are not used to develop important 21st century skills.

Although policy changes expected classroom practices to change, this was not evident in the schools sampled. The transition from using ICT for successful curriculum delivery to improving learning with the integration of ICT has not taken place. The expectation that ICT will transform education has not been met. Teachers should not use technology more in the classroom, but rather use it more effectively. This study agrees with the literature that the development of 21st century skills is not advanced by the use of ICT. Technology does not drive change as hoped by policymakers, but rather augments change (Department of Telecommunications and Postal Services, 2017).

The advice of Bill Gates should be taken seriously, as he stated "Technology must be implemented as part of a thoughtful, holistic approach to education transformation that includes teacher training, relevant curricula, parental involvement, and programs for children that fill unmet needs for basics" (Gates, n.d.).

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APPENDICES

ADDENDUM A – LETTER OF APPROVAL: GAUTENG EDUCATION DEPARTMENT

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	**01 June 2020**
Validity of Research Approval:	**04 February 2020 – 30 September 2020** **2019/459**
Name of Researcher:	**Avrakotos F**
Address of Researcher:	**Cnr Langenhoven & Jan Neethling Street**
	Chrissiefontein
Telephone Number:	**0826790051**
Email address:	**fotienea@gmail.com**
Research Topic:	**21st century skills Integrating technology into education**
Type of qualification	**M.Ed ICT**
Number and type of schools:	**55 Secondary School**
District/s/HO	**Guateng West, Ekurhuleni South, Sedibeng West**

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

1. *Letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.*

01/06/2020

Making education a societal priority

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

2. *The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.*
3. *A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.*
4. *A letter / document that outline the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.*
5. *The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.*
6. *Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.*
7. *Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year.*
8. *Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.*
9. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
10. *The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.*
11. *The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.*
12. *On completion of the study the researcher/s must supply the Director: Knowledge Management & Research with one Hard Cover bound and an electronic copy of the research.*
13. *The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.*
14. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

.....

Mr Gumani Mukatuni
Acting CES: Education Research and Knowledge Management

DATE: .....01 June 2020.....

ADDENDUM B – ETHICAL CLEARANCE FORM UNIVERSITY OF JOHANNESBURG

NHREC Registration Number REC-110613-036

UNIVERSITY OF JOHANNESBURG

ETHICS CLEARANCE

Dear Fotiene Avrakotos,

Ethical Clearance Number: Sem 2-2020-006

Topic: The integration of ICT to enhance 21st century skills in schools

Ethical clearance for this study is granted subject to the following conditions:

- If there are major revisions to the research proposal based on recommendations from the Faculty Higher Degrees Committee, a new application for ethical clearance must be submitted.
- If the research question changes significantly so as to alter the nature of the study, it remains the duty of the student/researcher to submit a new application.
- It remains the student's/researcher's responsibility to ensure that all ethical forms and documents related to the research are kept in a safe and secure facility and are available on demand.
- Please quote the reference number above in all future communications and documents.

The Faculty of Education Research Ethics Committee has decided to

☒ Grant ethical clearance for the proposed research.
☐ Provisionally grant ethical clearance for the proposed research
☐ Recommend revision and resubmission of the ethical clearance documents

Sincerely,

Prof Mdu Ndlovu
Chair: FACULTY OF EDUCATION RESEARCH ETHICS COMMITTEE
22 July 2020

ADDENDUM C – CONFIRMATION OF DATA ANALYSIS

M de Bruyn
Research Assistance

ATTENTION:
Foteine Avrakotos

DATE: 2020/08/04

CONFIRMATION OF DATA ANALYSIS

This document serves as confirmation that the following data analysis was conducted on the data of Ms. F Avrakotos using IBM SPSS Statistics (version 22):

- Descriptive statistics
  Frequency tables of 80 questions
- Inferential Statistics
  Chi-square analysis to test for an association between teaching with ICTs' and obtaining 21st century skills.

I, Melanie de Bruyn, declare that the analysis was conducted by myself and completed on 27/07/2020. The data analysis and results are authentic to the best of my knowledge.

Melanie de Bruyn

BSc. Medical Microbiology (UFS)
BSc. (hons) Behavioural Genetics (UFS)
M-Tech. Agriculture (CUT)
Data analysis course (UCT)

ENQUIRIES
073 183 3487 / melaniedebruyn@outlook.com

ADDENDUM D – LANGUAGE EDITING CERTIFICATE

Editing Service: Lee Kemp

14 Carlisle St

Mount Croix

Port Elizabeth

6001

23 September 2020

082 723 5408

TO WHOM IT MAY CONCERN

EDITING OF MINI-DISSERTATION: FOTIENE AVRAKOTOS (218105228)

This serves to confirm that I edited Fotiene Avrakotos's Magister Educationis Mini-Dissertation

The editing covered all aspects of language, punctuation, and layout. I also checked the in-text referencing technique.

Yours faithfully

Ms L. Kemp

B. A. (Hons English); MBA

Member: Nelson Mandela University Editors' Forum

ADDENDUM E – LETTER TO PRINCIPAL

June 2020

REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT YOUR SCHOOL

Dear Principal

I am a Master's in Education (ICT) student at the University of Johannesburg. I hereby request your permission to carry out my empirical research at your school.

The theme of the research is **The use of ICT's in schools to teach 21st century skills**. The aim of the research is to determine whether teachers perceive themselves teaching the necessary ICT skills so that students can compete in a global market: critical thinking; collaboration; communication; creativity and innovation. The research will assist principals and school management teams to ascertain whether their teachers are teaching the necessary ICT skills and would allow school management teams to integrate the teaching of ICT skills in their schools. The research will be done through an online questionnaire, which will be conducted with CAT and/or IT, Mathematics and Mathematical Literacy teachers from your school. The questionnaire can be completed after school hours and would therefore not affect the teaching time.

The research will be guided by a strict code of ethics and all information will be regarded as confidential. Ethical clearance for the project has been obtained from the UJ Ethics Review Committee and the Gauteng Department of Education. Permission will be sought from the teachers prior to their participation in the research. Only those who consent will participate. No personal details of any respondent will be mentioned in the findings, nor will any results be related to any particular school.

The research report will be published by the University of Johannesburg and could be obtained for further perusal.

For any questions you are more than welcome to contact my supervisor.

Sincere regards

Fotiene Avrakotos
Researcher – 082 679 0051
Email: fotienea@gmail.com

Prof Dirk Postma
Supervisor – 012 429 4065
Email: postmdj@unisa.ac.za

ADDENDUM F – INVITATION LETTER TO PARTICIPANTS

Dear participant

My name is Fotiene Avrakotos. I am currently conducting research (in fulfilment of the requirements for a Master's in Education (ICT)) regarding the use of ICT's in schools to teach 21st century skills and I am asking for your assistance. Please consider participating in the study. Your responses to the questionnaire are vital in assisting me to determine the status of the use of ICT's to teach 21st century skills in a number of selected schools in Gauteng.

CONFIDENTIALITY

All information will be regarded as confidential, and no personal details of any respondent will be mentioned in the findings, nor will any results be related to any particular school. The contents of the survey will not be discussed with your principal, nor will it be part of the teacher evaluation process. Although the research report will be published, it will contain figures, percentages and deductions based on the analysis and interpretation of the data provided, without identifying any respondent personally. Participation in this survey is voluntary and you may choose not to participate without being advantaged or disadvantaged in any way.

RISKS

This study is conducted under the supervision Prof Dirk Postma, University of Johannesburg. Any questions concerning this study may be addressed to the researcher or the supervisor. There are, therefore, no risks associated with this study. Your participation will be much appreciated and I am most grateful for your time and consideration.

Sincere regards

Fotiene Avrakotos
Researcher – 082 679 0051
Email: fotienea@gmail.com

Prof Dirk Postma
Supervisor – 012 429 4065
Email: postmdj@unisa.ac.za

ADDENDUM G – CONSENT FORM

Consent Form

University of Johannesburg

Project: Master's in education (ICT)

Responsible Researcher: Fotiene Avrakotos

Name of Participant: _____

1. I consent to participate in this research, the details of which have been explained to me, and I have been provided with a written plain language statement to keep.
2. I understand that the purpose of this research is to investigate *the integration of ICT in classrooms to teach 21st century skills.*
3. I understand that my participation in this research is for research purposes only.
4. I acknowledge that the possible effects of participating in this research project have been explained to my satisfaction.
5. In this project I will be required to *complete an online questionnaire.*
6. I understand that my participation is voluntary and that I am free to withdraw from this project anytime without explanation or prejudice and to withdraw any unprocessed data that I have provided.
7. I understand that the data from this research will be stored at the University of Johannesburg and will be destroyed after 5 years.
8. I have been informed that the confidentiality of the information I provide will be safeguarded subject to any legal requirements; my data will be password protected and accessible only by the named researchers.
9. I understand that after I sign and return this consent form, it will be retained by the researcher.

Participant Signature: _____ **Date:** _____

ADDENDUM H – QUESTIONNAIRE

21st century skills: Integrating technology into education

Dear participant

My name is Fotiene Avrakotos. I am currently conducting research (in fulfilment of the requirements for a Master's in Education (ICT)) regarding the use of ICT's in schools to teach 21st century skills and I am asking for your assistance. Please consider participating in the study. Your responses to the questionnaire are vital in assisting me to determine the status of the use of ICT's to teach 21st century skills in a number of selected schools in Gauteng.

CONFIDENTIALITY

All information will be regarded as confidential, and no personal details of any respondent will be mentioned in the findings, nor will any results be related to any particular school. The contents of the survey will not be discussed with your principal, nor will it be part of the teacher evaluation process. Although the research report will be published, it will contain figures, percentages and deductions based on the analysis and interpretation of the data provided, without identifying any respondent personally. Participation in this survey is voluntary and you may choose not to participate without being advantaged or disadvantaged in any way.

RISKS

This study is conducted under the supervision Prof Dirk Postma, University of Johannesburg. Any questions concerning this study may be addressed to the researcher or the supervisor. There are, therefore, no risks associated with this study. Your participation will be much appreciated and I am most grateful for your time and consideration.

Sincere regards

Fotiene Avrakotos

Researcher – 082 679 0051

Email: fotienea@gmail.com

Prof Dirk Postma

Supervisor – 012 429 4065

Email: postmdj@unisa.ac.za

Instructions

This survey asks about your teaching practices that might support students' learning of the following 21st century skills:

Critical Thinking Collaboration
Communication
Creativity & Innovation
Self-Direction
Making Global Connections
Making Local Connections
Using Technology as a Tool for Learning

For each of the above you will be asked about your general teaching of these skills, and about a few specific practices you may have used.

There are no correct or incorrect answers and all responses will be kept confidential.

Consent Form

Researcher: Fotiene Avrakotos

Name of Participant *

Consent *

☐ I consent to participate in this research, the details of which have been explained to me

☐ I understand that the purpose of this research is to investigate the integration of ICT in classrooms to teach 21st century skills

☐ I understand that my participation in this research is for research purposes only

☐ I acknowledge that the possible effects of participating in this research project have been explained to my satisfaction

☐ In this project I will be required to complete an online questionnaire

☐ I understand that my participation is voluntary and that I am free to withdraw from this project anytime without explanation or prejudice and to withdraw any unprocessed data that I have provided

☐ I understand that the data from this research will be stored at the University of Johannesburg and will be destroyed after 5 years

☐ I have been informed that the confidentiality of the information I provide will be safeguarded subject to any legal requirements; my data will be password protected and accessible only by the named researcher I understand that after I sign and return this consent form, it will be retained by the researcher

Date *

Month Day Year

Personal Demographics

1. Gender *

O Male
O Female
O Other

2. Age *

3. Highest teaching qualification *

Postgraduate Certificate in Education

4. Which grade(s) do you teach? *

☐ Grade 8
☐ Grade 9
☐ Grade 10
☐ Grade 11
☐ Grade 12

5. Which subject(s) do you teach? *

☐ Mathematics
☐ Mathematical Literacy
☐ Computer Applications Technology
☐ Information Technology
☐ Other: _____

6. Number of years of teaching experience *

7. Years of teaching with Information and Communication Technologies (ICT's) *

8. Name of school/institution in which you are currently teaching *

9. Location of school *

10. Type of school *

O Private/Independent
O Public

CRITICAL THINKING SKILLS

Critical thinking skills refer to students being able to analyse complex problems, investigate questions for which there are no clear-cut answers, evaluate different points of view or sources of information, and draw appropriate conclusions based on evidence and reasoning

1. In teaching of your class, how often have you asked students to do the following? *

	Almost never	A few times a term	One to three times per month	One to three times per week	Almost daily
A. Compare information from different sources before completing a task or assignment?	O	O	O	O	O
B. Draw their own conclusions based on analysis of numbers, facts, or relevant information?	O	O	O	O	O
C. Summarize or create their own interpretation of what they have read or been taught?	O	O	O	O	O
D. Analyse competing arguments, perspectives or solutions to a problem?	O	O	O	O	O
E. Develop a persuasive argument based on supporting evidence or reasoning?	O	O	O	O	O
F. Try to solve complex problems or answer questions that have no single correct solution or answer?	O	O	O	O	O

2. What is your understanding of 'critical thinking skills'. *

O A process by which we use our knowledge and intelligence to effectively arrive at the most reasonable positions on issues

O Critical thinking is reasonable, reflective thinking that is focused on deciding what to believe or do

O Critical thinking refers to the ability to analyse information objectively and make a reasoned judgment. It involves the evaluation of sources, such as data, facts, observable phenomena, and research findings

O Critical thinking is thinking about your thinking, while you're thinking, in order to make your thinking better

3. To what extent do you agree with these statements about your class? *

	Not really	To a minor extent	To a moderate extent	To a great extent	To a very great extent
A. I have tried to develop students' critical thinking skills	O	O	O	O	O
B. Most students have learned critical thinking skills while in my class	O	O	O	O	O
C. I have been able to effectively assess students' critical thinking skills	O	O	O	O	O

COLLABORATION SKILLS

Collaboration skills refer to students being able to work together to solve problems or answer questions, to work effectively and respectfully in teams to accomplish a common goal and to assume shared responsibility for completing a task.

1. In teaching of your class, how often have you asked students to do the following? *

	Almost never	A few times a term	One to three times per month	One to three times per week	Almost daily
A. Work in pairs or small groups to complete a task together?	O	O	O	O	O
B. Work with other students to set goals and create a plan for their team?	O	O	O	O	O
C. Create joint products using contributions from each student?	O	O	O	O	O
D. Present their group work to the class, teacher or others?	O	O	O	O	O
E. Work as a team to incorporate feedback on group tasks or products?	O	O	O	O	O
F. Give feedback to peers or assess other students' work	O	O	O	O	O

2. What is your understanding of 'collaboration skills'. *

O Knowing how to cooperate well with others will support workplace efficiency, aid in career advancement and help you and your team achieve better outcomes

O The behaviours that help two or more people work together and function well in the process

O Working in teams, negotiating, communicating, motivating others and following orders

O Collaboration depends largely on the ability to simply join in, to commit yourself to working with others, listening to what others have to say and encouraging them to speak up and speaking up yourself when you have an idea or opinion

3. To what extent do you agree with these statements about your class? *

	Not really	To a minor extent	To a moderate extent	To a great extent	To a very great extent
A. I have tried to develop students' collaboration skills	O	O	O	O	O
B. Most students have learned collaboration skills while in my class	O	O	O	O	O
C. I have been able to effectively assess students' collaboration skills	O	O	O	O	O

COMMUNICATION SKILLS

Communication skills refer to students being able to organize their thoughts, data and findings and share these effectively through a variety of media, as well as orally and in writing.

1. In teaching of your class, how often have you asked students to do the following? *

	Almost never	A few times a term	One to three times per month	One to three times per week	Almost daily
A. Structure data for use in written products or oral presentations (e.g., creating charts, tables or graphs)?	O	O	O	O	O
B. Convey their ideas using media other than a written paper (e.g., posters, video, blogs, etc.)	O	O	O	O	O
C. Prepare and deliver an oral presentation to the teacher or others?	O	O	O	O	O
D. Answer questions in front of an audience?	O	O	O	O	O
E. Decide how they will present their work or demonstrate their learning?	O	O	O	O	O

2. What is your understanding of 'communication skills'. *

O Every communication involves one sender, a message and a recipient

O The ability to convey information to another effectively and efficiently

O Communication is simply the act of transferring information from one place, person or group to another

O The successful conveying or sharing of ideas and feelings

3. To what extent do you agree with these statements about your class? *

	Not really	To a minor extent	To a moderate extent	To a great extent	To a very great extent
A. I have tried to develop students' communication skills	O	O	O	O	O
B. Most students have learned communication skills while in my class	O	O	O	O	O
C. I have been able to effectively assess students' communication skills	O	O	O	O	O

CREATIVITY AND INNOVATION SKILLS

Creativity and Innovation skills refer to students being able to generate and refine solutions to complex problems or tasks based on synthesis, analysis and then combining or presenting what they have learned in new and original ways.

1. In teaching of your class, how often have you asked students to do the following? *

	Almost never	A few times a term	One to three times per month	One to three times per week	Almost daily
A. Use idea creation techniques such as brainstorming or concept mapping?	O	O	O	O	O
B. Generate their own ideas about how to confront a problem or question?	O	O	O	O	O
C. Test out different ideas and work to improve them?	O	O	O	O	O
D. Invent a solution to a complex, open-ended question or problem?	O	O	O	O	O
E. Create an original product or performance to express their ideas?	O	O	O	O	O

2. What is your understanding of 'creativity and innovation skills'. *

O The ability to connect the seemingly unconnected
O Creativity is characterised by the ability to perceive the world in new ways
O Creativity is the act of turning new and imaginative ideas into reality
O If you are able to make something, you are creative

3. To what extent do you agree with these statements about your class? *

	Not really	To a minor extent	To a moderate extent	To a great extent	To a very great extent
A. I have tried to develop students' creativity and innovation skills	O	O	O	O	O
B. Most students have learned creativity and innovation skills while in my class	O	O	O	O	O
C. I have been able to effectively assess students' creativity and innovation skills	O	O	O	O	O

SELF-DIRECTION SKILLS

Self-Direction skills refer to students being able to take responsibility for their learning by identifying topics to pursue and processes for their own learning and being able to review their own work and respond to feedback.

1. In teaching of your class, how often have you asked students to do the following? *

	Almost never	A few times a term	One to three times per month	One to three times per week	Almost daily
A. Take initiative when confronted with a difficult problem or question?	O	O	O	O	O
B. Choose their own topics of learning or questions to pursue?	O	O	O	O	O
C. Plan the steps they will take to accomplish a complex task?	O	O	O	O	O
D. Choose for themselves what examples to study or resources to use?	O	O	O	O	O
E. Monitor their own progress towards completion of a complex task and modify their work accordingly?	O	O	O	O	O
F. Use specific criteria to assess the quality of their work before it is completed?	O	O	O	O	O
G. Use peer, teacher or expert feedback to revise their work?	O	O	O	O	O

2. What is your understanding of 'self-direction skills'. *

O The ability to manage tasks without having them directed by others

O A process by which individuals take the initiative, with or without the assistance of others

O Self-direction is enhanced in social contexts and we need social skills to be able to interact with those who can help us achieve

O A continuous engagement in acquiring, applying and creating knowledge and skills

3. To what extent do you agree with these statements about your class? *

	Not really	To a minor extent	To a moderate extent	To a great extent	To a very great extent
A. I have tried to develop students' self-direction skills	O	O	O	O	O
B. Most students have learned self-direction skills while in my class	O	O	O	O	O
C. I have been able to effectively assess students' self-direction skills	O	O	O	O	O

GLOBAL CONNECTIONS

Global Connections refers to students being able to understand global, geo-political issues including awareness of geography, culture, language, history, and literature from other countries.

1. In teaching of your class, how often have you asked students to do the following? *

	Almost never	A few times a term	One to three times per month	One to three times per week	Almost daily
A. Study information about other countries or cultures?	O	O	O	O	O
B. Use information or ideas that come from people in other countries or cultures?	O	O	O	O	O
C. Discuss issues related to global interdependency (for example, global environment trends, global market economy)?	O	O	O	O	O
D. Understand the life experiences of people in cultures besides their own?	O	O	O	O	O
E. Study the geography of distant countries?	O	O	O	O	O
F. Reflect on how their own experiences and local issues are connected to global issues?	O	O	O	O	O

2. What is your understanding of 'global connections'. *

O Skills that enable us to operate in any context

O Communication with people of other cultures, religions, and languages

O Cultural awareness, language and communication skills, international awareness and networking

O Global skills are those skills that enable us to communicate in an international context

3. To what extent do you agree with these statements about your class? *

	Not really	To a minor extent	To a moderate extent	To a great extent	To a very great extent
A. I have tried to develop students' skills in making global connections	O	O	O	O	O
B. Most students have learned to make global connections while in my class	O	O	O	O	O
C. I have been able to effectively assess students' skills in making global connections	O	O	O	O	O

LOCAL CONNECTIONS

Local Connections refers to students being able to apply what they have learned to local contexts and community issues.

1. In teaching of your class, how often have you asked students to do the following? *

	Almost never	A few times a term	One to three times per month	One to three times per week	Almost daily
A. Investigate topics or issues that are relevant to their family or community?	O	O	O	O	O
B. Apply what they are learning to local situations, issues or problems?	O	O	O	O	O
C. Talk to one or more members of the community about a class project or activity?	O	O	O	O	O
D. Analyse how different stakeholder groups or community members view an issue?	O	O	O	O	O
E. Respond to a question or task in a way that weighs the concerns of different community members or groups?	O	O	O	O	O

2. What is your understanding of 'local connections'. *

O Having family or friends living in different towns
O Communication with people in different languages
O Connecting with teachers from other schools
O Being able to form connections within your area

3. To what extent do you agree with these statements about your class? *

	Not really	To a minor extent	To a moderate extent	To a great extent	To a very great extent
A. I have tried to develop students' skills in making local connections	O	O	O	O	O
B. Most students have learned to make local connections while in my class	O	O	O	O	O
C. I have been able to effectively assess students' skills in making local connections	O	O	O	O	O

USING TECHNOLOGY AS A TOOL FOR LEARNING

Using technology as a tool for learning refers to students being able to manage their learning and produce products using appropriate information and communication technologies

1. In teaching of your class, how often have you asked students to do the following? *

	Almost never	A few times a term	One to three times per month	One to three times per week	Almost daily
A. Use technology or the Internet for self-instruction (e.g., Kahn Academy or other videos, tutorials, self-instructional websites, etc.)?	O	O	O	O	O
B. Select appropriate technology tools or resources for completing a task?	O	O	O	O	O
C. Evaluate the credibility and relevance of online resources?	O	O	O	O	O
D. Use technology to analyse information (e.g., databases, spreadsheets, graphic programs, etc.)?	O	O	O	O	O
E. Use technology to help them share information (e.g., multi-media presentations using sound or video, presentation software, blogs, podcasts, etc.)?	O	O	O	O	O
F. Use technology to support teamwork or collaboration (e.g., shared workspaces, email exchanges, giving and receiving feedback, etc.)?	O	O	O	O	O
G. Use technology to interact directly with experts or members of local/global communities?	O	O	O	O	O
H. Use technology to keep track of their work on extended tasks or assignments?	O	O	O	O	O

2. What is your understanding of using technology as a tool for learning? *

O ICT's can be used for teaching and learning

O ICT's force a new way of teaching and learning

O ICT's are mainly an addition to teaching and learning

O Technology is a tool that can change the nature of teaching and learning

3. To what extent do you agree with these statements about your class? *

	Not really	To a minor extent	To a moderate extent	To a great extent	To a very great extent
A. I have tried to develop students' skills in using technology as a tool for learning	O	O	O	O	O
B. Most students have learned to use technology as a tool for learning while in my class	O	O	O	O	O
C. I have been able to effectively assess students' skills in using technology for learning	O	O	O	O	O

Thank you for your time

ADDENDUM I – TABLES FROM DATA ANALYSIS

Critical thinking skills

Table I.1: Critical thinking skills: Compare information

1. In teaching of your class, how often have you asked students the following?

Compare information from different sources before completing a task or assignment?

		Frequency	Percent	Valid Percent
Valid	Almost never	14	13.5	13.5
	A few times a term	34	32.7	32.7
	One to three times per month	19	18.3	18.3
	One to three times per week	29	27.9	27.9
	Almost daily	8	7.7	7.7
	Total	104	100.0	100.0

Most participants (32.7%) indicated a few times a term.

Table I.2: Critical thinking skills: Draw conclusions

Draw their own conclusions based on analysis of numbers, facts, or relevant information?

		Frequency	Percent	Valid Percent
Valid	Almost never	4	3.8	3.8
	A few times a term	34	32.7	32.7
	One to three times per month	30	28.8	28.8
	One to three times per week	24	23.1	23.1
	Almost daily	12	11.5	11.5
	Total	104	100.0	100.0

Most participants (32.7%) indicated a few times a term.

Table I.3: Critical thinking skills: Create interpretations

Summarize or create their own interpretation of what they have read or been taught?

		Frequency	Percent	Valid Percent
Valid	Almost never	7	6.7	6.7
	A few times a term	29	27.9	27.9
	One to three times per month	26	25.0	25.0
	One to three times per week	27	26.0	26.0
	Almost daily	15	14.4	14.4
	Total	104	100.0	100.0

Most participants (27.9%) indicated a few times a term.

Table I.4: Critical thinking skills: Analyse

Analyse competing arguments, perspectives or solutions to a problem?

		Frequency	Percent	Valid Percent
Valid	Almost never	13	12.5	12.5
	A few times a term	29	27.9	27.9
	One to three times per month	24	23.1	23.1
	One to three times per week	26	25.0	25.0
	Almost daily	12	11.5	11.5
	Total	104	100.0	100.0

Most participants (27.9%) indicated a few times a term.

Table I.5: Critical thinking skills: Develop arguments

Develop a persuasive argument based on supporting evidence or reasoning?

		Frequency	Percent	Valid Percent
Valid	Almost never	12	11.5	11.5
	A few times a term	32	30.8	30.8
	One to three times per month	25	24.0	24.0
	One to three times per week	24	23.1	23.1
	Almost daily	11	10.6	10.6
	Total	104	100.0	100.0

Most participants (30.8%) indicated a few times a term.

Table I.6: Critical thinking skills: Solve problems

Try to solve complex problems or answer questions that have no single correct solution or answer?

		Frequency	Percent	Valid Percent
Valid	Almost never	15	14.4	14.4
	A few times a term	23	22.1	22.1
	One to three times per month	25	24.0	24.0
	One to three times per week	24	23.1	23.1
	Almost daily	17	16.3	16.3
	Total	104	100.0	100.0

Most participants (24.0%) indicated one to three times per month.

Table I.7: Acquiring critical thinking skills

Most students have learned critical thinking skills while in my class

		Frequency	Percent	Valid Percent
Valid	Not really	5	4.8	4.8
	To a minor extent	20	19.2	19.2

Most students have learned critical thinking skills while in my class

		Frequency	Percent	Valid Percent
	To a moderate extent	56	53.8	53.8
	To a great extent	20	19.2	19.2
	To a very great extent	3	2.9	2.9
	Total	104	100.0	100.0

Most participants (53.8%) agreed to a moderate extent.

Table I.8: Assess critical thinking skills

I have been able to effectively assess students' critical thinking skills

		Frequency	Percent	Valid Percent
Valid	Not really	9	8.7	8.7
	To a minor extent	21	20.2	20.2
	To a moderate extent	51	49.0	49.0
	To a great extent	18	17.3	17.3
	To a very great extent	5	4.8	4.8
	Total	104	100.0	100.0

Most participants (49.0%) agreed to a moderate extent.

Collaboration skills

Table I.9: Collaboration skills: Work in groups

1. In teaching of your class, how often have you asked students the following?

Work in pairs or small groups to complete a task together?

		Frequency	Percent	Valid Percent
Valid	Almost never	29	27.9	27.9
	A few times a term	36	34.6	34.6
	One to three times per month	25	24.0	24.0
	One to three times per week	10	9.6	9.6
	Almost daily	4	3.8	3.8
	Total	104	100.0	100.0

Most participants (34.6%) indicated a few times a term.

Table I.10: Collaboration skills: Work with other students

Work with other students to set goals and create a plan for their team?

		Frequency	Percent	Valid Percent
Valid	Almost never	31	29.8	29.8
	A few times a term	42	40.4	40.4
	One to three times per month	22	21.2	21.2

Work with other students to set goals and create a plan for their team?

		Frequency	Percent	Valid Percent
	One to three times per week	8	7.7	7.7
	Almost daily	1	1.0	1.0
	Total	104	100.0	100.0

Most participants (40.4%) indicated a few times a term.

Table I.11: Collaboration skills: Create joint products

Create joint products using contributions from each student?

		Frequency	Percent	Valid Percent
Valid	Almost never	40	38.5	38.5
	A few times a term	41	39.4	39.4
	One to three times per month	11	10.6	10.6
	One to three times per week	8	7.7	7.7
	Almost daily	4	3.8	3.8
	Total	104	100.0	100.0

Most participants (39.4%) indicated a few times a term.

Table I.12: Collaboration skills: Present group work

Present their group work to the class, teacher or others?

		Frequency	Percent	Valid Percent
Valid	Almost never	42	40.4	40.4
	A few times a term	36	34.6	34.6
	One to three times per month	18	17.3	17.3
	One to three times per week	6	5.8	5.8
	Almost daily	2	1.9	1.9
	Total	104	100.0	100.0

Most participants (40.4%) indicated almost never.

Table I.13: Collaboration skills: Incorporate feedback

Work as a team to incorporate feedback on group tasks or products?

		Frequency	Percent	Valid Percent
Valid	Almost never	45	43.3	43.3
	A few times a term	32	30.8	30.8
	One to three times per month	16	15.4	15.4
	One to three times per week	8	7.7	7.7
	Almost daily	3	2.9	2.9
	Total	104	100.0	100.0

Most participants (43.3%) indicated almost never.

Table I.14: Collaboration skills: Give feedback

Give feedback to peers or assess other students' work

		Frequency	Percent	Valid Percent
Valid	Almost never	32	30.8	30.8
	A few times a term	36	34.6	34.6
	One to three times per month	25	24.0	24.0
	One to three times per week	8	7.7	7.7
	Almost daily	3	2.9	2.9
	Total	104	100.0	100.0

Most participants (34.6%) indicated a few times a term.

Table I.15: Acquiring collaboration skills

Most students have learned collaboration skills while in my class

		Frequency	Percent	Valid Percent
Valid	Not really	13	12.5	12.5
	To a minor extent	42	40.4	40.4
	To a moderate extent	34	32.7	32.7
	To a great extent	14	13.5	13.5
	To a very great extent	1	1.0	1.0
	Total	104	100.0	100.0

Most participants (40.4%) agreed to a minor extent.

Table I.16: Assess collaboration skills

I have been able to effectively assess students' collaboration skills

		Frequency	Percent	Valid Percent
Valid	Not really	23	22.1	22.1
	To a minor extent	44	42.3	42.3
	To a moderate extent	24	23.1	23.1
	To a great extent	12	11.5	11.5
	To a very great extent	1	1.0	1.0
	Total	104	100.0	100.0

Most participants (42.3%) agreed to a minor extent.

Communication skills

Table I.17: Communication skills: Structure data

1. In teaching of your class, how often have you asked students the following?

Structure data for use in written products or oral presentations (e.g., creating charts, tables or graphs)?

		Frequency	Percent	Valid Percent
Valid	Almost never	8	7.7	7.7
	A few times a term	36	34.6	34.6
	One to three times per month	26	25.0	25.0
	One to three times per week	25	24.0	24.0
	Almost daily	9	8.7	8.7
	Total	104	100.0	100.0

Most participants (34.6%) indicated a few times a term.

Table I.18: Communication skills: Using media

Convey their ideas using media other than a written paper (e.g., posters, video, blogs, etc.)

		Frequency	Percent	Valid Percent
Valid	Almost never	26	25.0	25.0
	A few times a term	40	38.5	38.5
	One to three times per month	23	22.1	22.1
	One to three times per week	8	7.7	7.7
	Almost daily	7	6.7	6.7
	Total	104	100.0	100.0

Most participants (38.5%) indicated a few times a term.

Table I.19: Communication skills: Prepare presentations

Prepare and deliver an oral presentation to the teacher or others?

		Frequency	Percent	Valid Percent
Valid	Almost never	50	48.1	48.1
	A few times a term	30	28.8	28.8
	One to three times per month	13	12.5	12.5
	One to three times per week	9	8.7	8.7
	Almost daily	2	1.9	1.9
	Total	104	100.0	100.0

Most participants (48.1%) indicated almost never.

Table I.20: Communication skills: Answer questions

Answer questions in front of an audience?

		Frequency	Percent	Valid Percent
Valid	Almost never	23	22.1	22.1
	A few times a term	21	20.2	20.2
	One to three times per month	20	19.2	19.2
	One to three times per week	18	17.3	17.3
	Almost daily	22	21.2	21.2
	Total	104	100.0	100.0

Most participants (22.1%) indicated almost never. However, there was a fairly even distribution among all responses to this question.

Table I.21: Communication skills: Decision on presenting work

Decide how they will present their work or demonstrate their learning?

		Frequency	Percent	Valid Percent
Valid	Almost never	26	25.0	25.0
	A few times a term	41	39.4	39.4
	One to three times per month	21	20.2	20.2
	One to three times per week	10	9.6	9.6
	Almost daily	6	5.8	5.8
	Total	104	100.0	100.0

Most participants (39.4%) indicated a few times a term.

Table I.22: Acquiring communication skills

Most students have learned communication skills while in my class

		Frequency	Percent	Valid Percent
Valid	Not really	6	5.8	5.8
	To a minor extent	24	23.1	23.1
	To a moderate extent	41	39.4	39.4
	To a great extent	27	26.0	26.0
	To a very great extent	6	5.8	5.8
	Total	104	100.0	100.0

Most participants (39.4%) agreed to a moderate extent.

Table I.23: Assess communication skills

I have been able to effectively assess students' communication skills

		Frequency	Percent	Valid Percent
Valid	Not really	12	11.5	11.5
	To a minor extent	28	26.9	26.9
	To a moderate extent	40	38.5	38.5
	To a great extent	17	16.3	16.3
	To a very great extent	7	6.7	6.7
	Total	104	100.0	100.0

Most participants (38.5%) agreed to a moderate extent.

Creativity and innovation skills

Table I.24: Creativity and innovation skills: Idea creation techniques

1. In teaching of your class, how often have you asked students the following?

Use idea creation techniques such as brainstorming or concept mapping?

		Frequency	Percent	Valid Percent
Valid	Almost never	17	16.3	16.3
	A few times a term	39	37.5	37.5
	One to three times per month	27	26.0	26.0
	One to three times per week	13	12.5	12.5
	Almost daily	8	7.7	7.7
	Total	104	100.0	100.0

Most participants (37.5%) indicated a few times a term.

Table I.25: Creativity and innovation skills: Generate ideas

Generate their own ideas about how to confront a problem or question?

		Frequency	Percent	Valid Percent
Valid	Almost never	8	7.7	7.7
	A few times a term	34	32.7	32.7
	One to three times per month	28	26.9	26.9
	One to three times per week	22	21.2	21.2
	Almost daily	12	11.5	11.5
	Total	104	100.0	100.0

Most participants (32.7%) indicated a few times a term.

Table I.26: Creativity and innovation skills: Test ideas

Test out different ideas and work to improve them?

		Frequency	Percent	Valid Percent
Valid	Almost never	10	9.6	9.6
	A few times a term	34	32.7	32.7
	One to three times per month	29	27.9	27.9
	One to three times per week	19	18.3	18.3
	Almost daily	12	11.5	11.5
	Total	104	100.0	100.0

Most participants (32.7%) indicated a few times a term.

Table I.27: Creativity and innovation skills: Invent a solution

Invent a solution to a complex, open-ended question or problem?

		Frequency	Percent	Valid Percent
Valid	Almost never	14	13.5	13.5
	A few times a term	32	30.8	30.8
	One to three times per month	29	27.9	27.9
	One to three times per week	21	20.2	20.2
	Almost daily	8	7.7	7.7
	Total	104	100.0	100.0

Most participants (30.8%) indicated a few times a term.

Table I.28: Creativity and innovation skills: Create original product

Create an original product or performance to express their ideas?

		Frequency	Percent	Valid Percent
Valid	Almost never	24	23.1	23.1
	A few times a term	31	29.8	29.8
	One to three times per month	22	21.2	21.2
	One to three times per week	22	21.2	21.2
	Almost daily	5	4.8	4.8
	Total	104	100.0	100.0

Most participants (29.8%) indicated a few times a term.

Table I.29: Acquiring creativity and innovation skills

Most students have learned creativity and innovation skills while in my class

		Frequency	Percent	Valid Percent
Valid	Not really	10	9.6	9.6
	To a minor extent	27	26.0	26.0
	To a moderate extent	45	43.3	43.3
	To a great extent	21	20.2	20.2
	To a very great extent	1	1.0	1.0
	Total	104	100.0	100.0

Most participants (43.3%) agreed to a moderate extent.

Table I.30: Assess creativity and innovation skills

I have been able to effectively assess students' creativity and innovation skills

		Frequency	Percent	Valid Percent
Valid	Not really	15	14.4	14.4
	To a minor extent	24	23.1	23.1
	To a moderate extent	43	41.3	41.3
	To a great extent	18	17.3	17.3
	To a very great extent	4	3.8	3.8
	Total	104	100.0	100.0

Most participants (41.3%) agreed to a moderate extent.

Self-direction skills

Table I.31: Self-direction skills: Take initiative

1. In teaching of your class, how often have you asked students the following?

Take initiative when confronted with a difficult problem or question?

		Frequency	Percent	Valid Percent
Valid	Almost never	2	1.9	1.9
	A few times a term	32	30.8	30.8
	One to three times per month	26	25.0	25.0
	One to three times per week	19	18.3	18.3
	Almost daily	25	24.0	24.0
	Total	104	100.0	100.0

Most participants (30.8%) indicated a few times a term.

Table I.32: Self-direction skills: Choose own topics

Choose their own topics of learning or questions to pursue?

		Frequency	Percent	Valid Percent
Valid	Almost never	28	26.9	26.9
	A few times a term	35	33.7	33.7
	One to three times per month	21	20.2	20.2
	One to three times per week	12	11.5	11.5
	Almost daily	8	7.7	7.7
	Total	104	100.0	100.0

Most participants (33.7%) indicated a few times a term.

Table I.33: Self-direction skills: Plan steps

Plan the steps they will take to accomplish a complex task?

		Frequency	Percent	Valid Percent
Valid	Almost never	9	8.7	8.7
	A few times a term	30	28.8	28.8
	One to three times per month	20	19.2	19.2
	One to three times per week	23	22.1	22.1
	Almost daily	22	21.2	21.2
	Total	104	100.0	100.0

Most participants (28.8%) indicated a few times a term.

Table I.34: Self-direction skills: Choose own resources

Choose for themselves what examples to study or resources to use?

		Frequency	Percent	Valid Percent
Valid	Almost never	15	14.4	14.4
	A few times a term	34	32.7	32.7
	One to three times per month	30	28.8	28.8
	One to three times per week	17	16.3	16.3
	Almost daily	8	7.7	7.7
	Total	104	100.0	100.0

Most participants (32.7%) indicated a few times a term.

Table I.35: Self-direction skills: Monitor own progress

Monitor their own progress towards completion of a complex task and modify their work accordingly?

		Frequency	Percent	Valid Percent
Valid	Almost never	11	10.6	10.6
	A few times a term	35	33.7	33.7

Monitor their own progress towards completion of a complex task and modify their work accordingly?

		Frequency	Percent	Valid Percent
	One to three times per month	30	28.8	28.8
	One to three times per week	16	15.4	15.4
	Almost daily	12	11.5	11.5
	Total	104	100.0	100.0

Most participants (33.7%) indicated a few times a term.

Table I.36: Self-direction skills: Use criteria to assess quality

Use specific criteria to assess the quality of their work before it is completed?

		Frequency	Percent	Valid Percent
Valid	Almost never	9	8.7	8.7
	A few times a term	29	27.9	27.9
	One to three times per month	36	34.6	34.6
	One to three times per week	17	16.3	16.3
	Almost daily	13	12.5	12.5
	Total	104	100.0	100.0

Most participants (34.6%) indicated one to three times per month.

Table I.37: Self-direction skills: Use feedback

Use peer, teacher or expert feedback to revise their work?

		Frequency	Percent	Valid Percent
Valid	Almost never	8	7.7	7.7
	A few times a term	25	24.0	24.0
	One to three times per month	40	38.5	38.5
	One to three times per week	16	15.4	15.4
	Almost daily	15	14.4	14.4
	Total	104	100.0	100.0

Most participants (38.5%) indicated one to three times per month.

Table I.38: Acquiring self-direction skills

Most students have learned self-direction skills while in my class

		Frequency	Percent	Valid Percent
Valid	Not really	9	8.7	8.7
	To a minor extent	31	29.8	29.8
	To a moderate extent	42	40.4	40.4
	To a great extent	17	16.3	16.3
	To a very great extent	5	4.8	4.8
	Total	104	100.0	100.0

Table I.39: Assess self-direction skills

Most participants (40.4%) agreed to a moderate extent.

I have been able to effectively assess students' self-direction skills

		Frequency	Percent	Valid Percent
Valid	Not really	15	14.4	14.4
	To a minor extent	26	25.0	25.0
	To a moderate extent	37	35.6	35.6
	To a great extent	24	23.1	23.1
	To a very great extent	2	1.9	1.9
	Total	104	100.0	100.0

Most participants (35.6%) agreed to a moderate extent.

Global connections

Table I.40: Global connections: Study about other cultures

1. In teaching of your class, how often have you asked students the following?

Study information about other countries or cultures?

		Frequency	Percent	Valid Percent
Valid	Almost never	49	47.1	47.1
	A few times a term	33	31.7	31.7
	One to three times per month	10	9.6	9.6
	One to three times per week	7	6.7	6.7
	Almost daily	5	4.8	4.8
	Total	104	100.0	100.0

Most participants (47.1%) indicated almost never.

Table I.41: Global connections: Use ideas from people in other countries

Use information or ideas that come from people in other countries or cultures?

		Frequency	Percent	Valid Percent
Valid	Almost never	46	44.2	44.2
	A few times a term	31	29.8	29.8
	One to three times per month	10	9.6	9.6
	One to three times per week	11	10.6	10.6
	Almost daily	6	5.8	5.8
	Total	104	100.0	100.0

Most participants (44.2%) indicated almost never.

Table I.42: Global connections: Global interdependency

Discuss issues related to global interdependency (for example, global environment trends, global market economy)?

		Frequency	Percent	Valid Percent
Valid	Almost never	30	28.8	28.8
	A few times a term	37	35.6	35.6
	One to three times per month	13	12.5	12.5
	One to three times per week	13	12.5	12.5
	Almost daily	11	10.6	10.6
	Total	104	100.0	100.0

Most participants (35.6%) indicated a few times a term.

Table I.43: Global connections: Understand life experiences

Understand the life experiences of people in cultures besides their own?

		Frequency	Percent	Valid Percent
Valid	Almost never	34	32.7	32.7
	A few times a term	38	36.5	36.5
	One to three times per month	13	12.5	12.5
	One to three times per week	13	12.5	12.5
	Almost daily	6	5.8	5.8
	Total	104	100.0	100.0

Most participants (36.5%) indicated a few times a term.

Table I.44: Global connections: Study geography

Study the geography of distant countries?

		Frequency	Percent	Valid Percent
Valid	Almost never	53	51.0	51.0
	A few times a term	32	30.8	30.8
	One to three times per month	11	10.6	10.6
	One to three times per week	6	5.8	5.8
	Almost daily	2	1.9	1.9
	Total	104	100.0	100.0

Most participants (51.0%) indicated almost never.

Table I.45: Global connections: Connection to global issues

Reflect on how their own experiences and local issues are connected to global issues?

		Frequency	Percent	Valid Percent
Valid	Almost never	36	34.6	34.6
	A few times a term	36	34.6	34.6

Reflect on how their own experiences and local issues are connected to global issues?

		Frequency	Percent	Valid Percent
	One to three times per month	12	11.5	11.5
	One to three times per week	12	11.5	11.5
	Almost daily	8	7.7	7.7
	Total	104	100.0	100.0

Most participants indicated almost never or a few times a term (34.6%) respectively.

Table I.46: Acquiring global connection skills

Most students have learned to make global connections while in my class

		Frequency	Percent	Valid Percent
Valid	Not really	41	39.4	39.4
	To a minor extent	30	28.8	28.8
	To a moderate extent	23	22.1	22.1
	To a great extent	9	8.7	8.7
	To a very great extent	1	1.0	1.0
	Total	104	100.0	100.0

Most participants (39.4%) said not really.

Table I.47: Assess global connections

I have been able to effectively assess students' skills in making global connections

		Frequency	Percent	Valid Percent
Valid	Not really	45	43.3	43.3
	To a minor extent	29	27.9	27.9
	To a moderate extent	23	22.1	22.1
	To a great extent	6	5.8	5.8
	To a very great extent	1	1.0	1.0
	Total	104	100.0	100.0

Most participants (43.3%) said not really.

Local connections

Table I.48: Local connections: Investigate local topics

1. In teaching of your class, how often have you asked students the following?

Investigate topics or issues that are relevant to their family or community?

		Frequency	Percent	Valid Percent
Valid	Almost never	15	14.4	14.4
	A few times a term	38	36.5	36.5
	One to three times per month	26	25.0	25.0

1. In teaching of your class, how often have you asked students the following?

Investigate topics or issues that are relevant to their family or community?

		Frequency	Percent	Valid Percent
	One to three times per week	12	11.5	11.5
	Almost daily	13	12.5	12.5
	Total	104	100.0	100.0

Most participants (36.5%) indicated a few times a term.

Table I.49: Local connections: Apply skills to local situations

Apply what they are learning to local situations, issues or problems?

		Frequency	Percent	Valid Percent
Valid	Almost never	15	14.4	14.4
	A few times a term	30	28.8	28.8
	One to three times per month	28	26.9	26.9
	One to three times per week	16	15.4	15.4
	Almost daily	15	14.4	14.4
	Total	104	100.0	100.0

Most participants (28.8%) indicated a few times a term.

Table I.50: Local connections: Talk to community

Talk to one or more members of the community about a class project or activity?

		Frequency	Percent	Valid Percent
Valid	Almost never	29	27.9	27.9
	A few times a term	34	32.7	32.7
	One to three times per month	21	20.2	20.2
	One to three times per week	13	12.5	12.5
	Almost daily	7	6.7	6.7
	Total	104	100.0	100.0

Most participants (32.7%) indicated a few times a term.

Table I.51: Local connections: Analyse views on local issues

Analyse how different stakeholder groups or community members view an issue?

		Frequency	Percent	Valid Percent
Valid	Almost never	31	29.8	29.8
	A few times a term	35	33.7	33.7
	One to three times per month	21	20.2	20.2
	One to three times per week	10	9.6	9.6
	Almost daily	7	6.7	6.7
	Total	104	100.0	100.0

Most participants (33.7%) indicated a few times a term.

Table I.52: Local connections: Respond to community questions

Respond to a question or task in a way that weighs the concerns of different community members or groups?

		Frequency	Percent	Valid Percent
Valid	Almost never	31	29.8	29.8
	A few times a term	29	27.9	27.9
	One to three times per month	24	23.1	23.1
	One to three times per week	14	13.5	13.5
	Almost daily	6	5.8	5.8
	Total	104	100.0	100.0

Most participants (29.8%) indicated almost never.

Table I.53: Acquiring local connection skills

Most students have learned to make local connections while in my class

		Frequency	Percent	Valid Percent
Valid	Not really	26	25.0	25.0
	To a minor extent	31	29.8	29.8
	To a moderate extent	31	29.8	29.8
	To a great extent	13	12.5	12.5
	To a very great extent	3	2.9	2.9
	Total	104	100.0	100.0

Most participants agreed to a minor or moderate extent (29.8%) respectively.

Table I.54: Assess local connection

I have been able to effectively assess students' skills in making local connections

		Frequency	Percent	Valid Percent
Valid	Not really	30	28.8	28.8
	To a minor extent	34	32.7	32.7
	To a moderate extent	25	24.0	24.0
	To a great extent	12	11.5	11.5
	To a very great extent	3	2.9	2.9
	Total	104	100.0	100.0

Most participants (32.7%) agreed to a minor extent.

Using technology as a tool for learning

Table I.55: Using technology as a tool: Use for self-instruction

1. In teaching of your class, how often have you asked students the following?

Use technology or the Internet for self-instruction (e.g., Kahn Academy or other videos, tutorials, self-instructional websites, etc.)?

		Frequency	Percent	Valid Percent
Valid	Almost never	8	7.7	7.7
	A few times a term	19	18.3	18.3
	One to three times per month	29	27.9	27.9
	One to three times per week	21	20.2	20.2
	Almost daily	27	26.0	26.0
	Total	104	100.0	100.0

Most participants (27.9%) indicated one to three times per month.

Table I.56: Using technology as a tool: Select technology tools

Select appropriate technology tools or resources for completing a task?

		Frequency	Percent	Valid Percent
Valid	Almost never	6	5.8	5.8
	A few times a term	19	18.3	18.3
	One to three times per month	29	27.9	27.9
	One to three times per week	20	19.2	19.2
	Almost daily	30	28.8	28.8
	Total	104	100.0	100.0

Most participants (28.8%) indicated almost daily.

Table I.57: Using technology as a tool: Evaluate resources

Evaluate the credibility and relevance of online resources?

		Frequency	Percent	Valid Percent
Valid	Almost never	11	10.6	10.6
	A few times a term	22	21.2	21.2
	One to three times per month	29	27.9	27.9
	One to three times per week	22	21.2	21.2
	Almost daily	20	19.2	19.2
	Total	104	100.0	100.0

Most participants (27.9%) indicated one to three times per month.

Table I.58: Using technology as a tool: Analyse information

Use technology to analyse information (e.g., databases, spreadsheets, graphic programs, etc.)?

		Frequency	Percent	Valid Percent
Valid	Almost never	8	7.7	7.7
	A few times a term	20	19.2	19.2
	One to three times per month	23	22.1	22.1
	One to three times per week	23	22.1	22.1
	Almost daily	30	28.8	28.8
	Total	104	100.0	100.0

Most participants (28.8%) indicated almost daily.

Table I.59: Using technology as a tool: Share information

Use technology to help them share information (e.g., multi-media presentations using sound or video, presentation software, blogs, podcasts, etc.)?

		Frequency	Percent	Valid Percent
Valid	Almost never	12	11.5	11.5
	A few times a term	17	16.3	16.3
	One to three times per month	26	25.0	25.0
	One to three times per week	19	18.3	18.3
	Almost daily	30	28.8	28.8
	Total	104	100.0	100.0

Most participants (28.8%) indicated almost daily.

Table I.60: Using technology as a tool: Use technology for collaboration

Use technology to support teamwork or collaboration (e.g., shared workspaces, email exchanges, giving and receiving feedback, etc.)?

		Frequency	Percent	Valid Percent
Valid	Almost never	14	13.5	13.5
	A few times a term	18	17.3	17.3
	One to three times per month	33	31.7	31.7
	One to three times per week	17	16.3	16.3
	Almost daily	22	21.2	21.2
	Total	104	100.0	100.0

Most participants (31.7%) indicated one to three times per month.

Table I.61: Using technology as a tool: Interact with technology

Use technology to interact directly with experts or members of local/global communities?

		Frequency	Percent	Valid Percent
Valid	Almost never	27	26.0	26.0
	A few times a term	18	17.3	17.3

Use technology to interact directly with experts or members of local/global communities?

		Frequency	Percent	Valid Percent
	One to three times per month	26	25.0	25.0
	One to three times per week	18	17.3	17.3
	Almost daily	15	14.4	14.4
	Total	104	100.0	100.0

Most participants (26.0%) indicated almost never.

Table I.62: Using technology as a tool: Keep track with technology

Use technology to keep track of their work on extended tasks or assignments?

		Frequency	Percent	Valid Percent
Valid	Almost never	22	21.2	21.2
	A few times a term	16	15.4	15.4
	One to three times per month	25	24.0	24.0
	One to three times per week	20	19.2	19.2
	Almost daily	21	20.2	20.2
	Total	104	100.0	100.0

Most participants (24.0%) indicated one to three times per month.

Table I.63: Acquiring using technology as a tool

Most students have learned to use technology as a tool for learning while in my class

		Frequency	Percent	Valid Percent
Valid	Not really	8	7.7	7.7
	To a minor extent	15	14.4	14.4
	To a moderate extent	29	27.9	27.9
	To a great extent	28	26.9	26.9
	To a very great extent	24	23.1	23.1
	Total	104	100.0	100.0

Most participants (27.9%) agreed to a moderate extent.

Table I.64: Assess using technology as a tool

I have been able to effectively assess students' skills in using technology for learning

		Frequency	Percent	Valid Percent
Valid	Not really	15	14.4	14.4
	To a minor extent	13	12.5	12.5
	To a moderate extent	27	26.0	26.0
	To a great extent	26	25.0	25.0
	To a very great extent	23	22.1	22.1
	Total	104	100.0	100.0

Most participants (26.0%) agreed to a moderate extent.